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COVER LETTER

Honorable Commissioner:

Enclosed herewith please find the following documents comprising a United States patent application: (1) specification, claims and drawings, (2) declaration of inventor(s), (3) transmittal letter and fee calculation sheet, (4) fee, (5) information disclosure statement and form(s) 1449, and (6) return receipt postcard.

Respectfully submitted this 5th day of November, 2001.

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CERTIFICATE OF MAILING

Honorable Commissioner:

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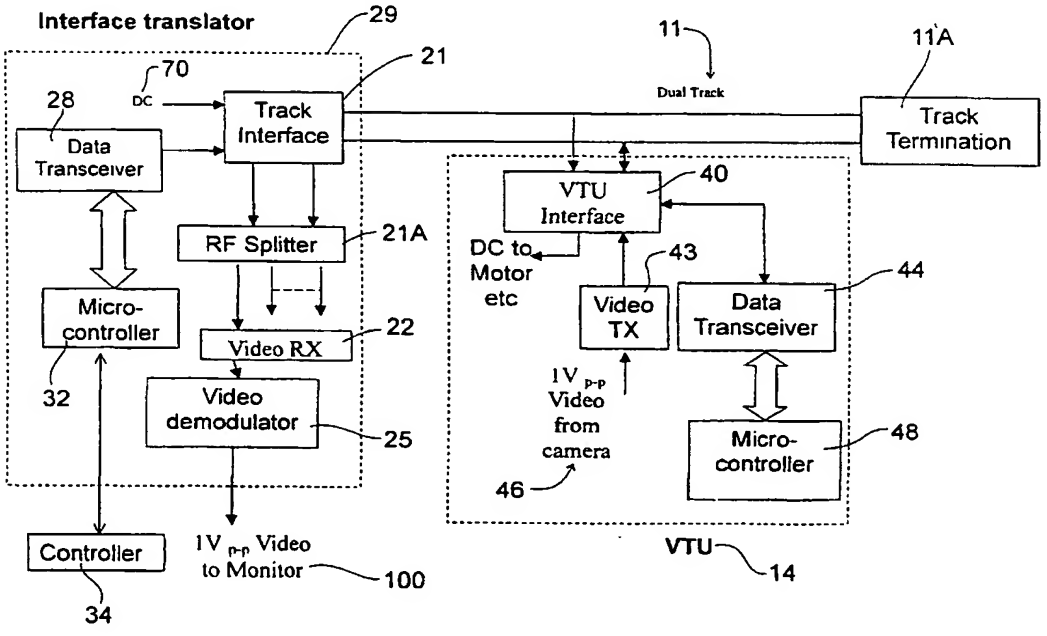

(57) Abstract

A surveillance system having two or more monitoring devices moving on a single track. The monitoring devices are suitably video cameras but may also include audio monitoring. Power for the monitoring devices, control signals and signals from the monitoring devices are all transmitted on the track. Power is suitably DC and other signals are suitably RF. The system incorporates collision avoidance means to prevent collision between adjacent moving cameras. The collision avoidance means includes hand–over software so that a person can seamlessly scan a region with camera control being passed to adjacent cameras to avoid collision.

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TITLE

"A SURVEILLANCE SYSTEM"

FIELD OF THE INVENTION

The present invention relates to a track mounted multiple mobile camera surveillance system.

BACKGROUND OF THE INVENTION

Remote cameras to survey an area are known and commonly used. Attaching movable surveillance cameras to a track system to permit viewing of different locations is also known and the subject of US Patent Nos. 4,656,509 and 4,510,526. These patents describe remote controlled carriage mounted cameras for surveying an area, but do not permit multiple cameras on a single track.

A typical video surveillance system is disclosed in Australian patent 359190 and comprises a track assembly which is mounted to a room ceiling. A movable carriage is able to travel repetitively back and forth along the track and is provided with a camera to transmit video images of monitored areas to a remote location.

The carriage in AU 359190 comprises two cameras mounted to a single platform, a drive assembly, drive control and video circuit boards. The cameras are mounted to the support platform at different angles in order to observe a wide area.

The track includes two conductors of copper tubing suitably mounted and supported within semi-cylindrical grooves of an isolation block made of electrically insulating material. Each conductor is in slidable contact with at least one corresponding isolated slidable electrically conductive brush located on the underside of the carriage.

Output signals from the cameras are provided to a video modulator board on the carriage which modulates suitable carrier signals for transmission through the conductors to a demodulator connected at

the end of the track. The demodulator demodulates each camera output signal from its respective carrier signal and displays the corresponding image on monitors.

Proximity sensors are located along the length of the track and these are hardwired back to a controlling interface system so that the location of the carriage is able to be monitored through the proximity sensors.

Power to the carriage is provided through the two conductors, so that the conductors carry both the power, control and video signals received from the cameras.

The above system has the drawback that it is not possible to accurately monitor more than one area at a single time because the single carriage carrying the cameras cannot be at two locations along the track simultaneously. Also, the above system requires maintenance of wearable parts such as conductive bushes which contact the conductors.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an apparatus to overcome one or more of the limitations of, or improve upon, the prior art as discussed above.

These and other objects, features and advantages of the present invention will become more apparent in the light of the detailed description of exemplary embodiments thereof, as illustrated by the accompanying drawings.

In one form, the invention resides in a surveillance system comprising:

an electrical conducting track;

two or more carriages movable on the track;

a driving means mounted on each carriage for moving each carriage to different locations along the track;

a power supply providing power to each carriage;

at least one monitoring device mounted on each carriage providing an output signal for a monitored location;

a modulation means receiving the output signal;

a transmission means for transmitting modulated output signals through the track;

a means for receiving and demodulating the transmitted modulated output signals;

a viewing means to view the demodulated output signal at a remote location; and

a control means for controlling movement of each carriage on the track.

The track suitably comprises at least one conductor. Preferably the track comprises three conductors, one transferring power, a second transferring video and control signals and a third as a ground conductor.

Each carriage comprises a data processor which includes position management software for recording the location of the carriage along the track, storing data on the location of each adjacent carriage, transmitting data relating to its position along the track to an interface translator, receiving and storing data relating to the location of each adjacent carriage from the interface translator and/or each adjacent carriage and controls movement of each carriage whereby collisions between adjacent carriages are avoided.

Another form of the invention provides a brushless means for transmitting information from a carriage to a conductor. This information includes data and/or output signals from a monitoring device, such as video, transmitted at radio frequency (RF).

Preferably, the control means includes means for avoiding collision of the carriages. A suitable means for avoiding collision comprises:

a location means to determine a location of each carriage on

the track;

a means for storing the location of each carriage;

a transmission means associated with each carriage for transmitting the carriage location;

a receiving means for receiving and monitoring the locations of each carriage; and

a means for controlling the location of each carriage to avoid collision of any carriages.

Preferably, the means for avoiding collisions between adjacent carriages provides a means for transmitting and receiving carriage positional information from each carriage and the interface translator. Each carriage and interface translator is able to monitor and store the locations of each carriage.

A suitable location means is a location or position sensor means comprising registration marks or position indicators associated with the track; means on the carriages to read the registration marks; means comprising a rotatable wheel on the carriages whereby wheel rotations represents distance travelled by the carriages; means to calculate a carriage position; means associated with each carriage for transmitting the position; means for receiving the positions of each carriage; and means for controlling the position of each carriage to avoid collision of any carriages.

The interface translator is suitably adapted to receive position data from each of the carriages and stores data on the position of each carriage based on the data received from the location means.

The collision avoidance means is suitably retrofitable to known surveillance systems.

The position management software comprises a means for allocating a priority value to each carriage at a particular time, whereby a carriage allocated a higher priority is commanded by the position management software to move to a predetermined location on the track

when the interface translator receives a command signal from a master controller.

The interface translator preferably comprises a microprocessor which is controlled by the position management software, memory storage for recording the position of each carriage and the minimum distance between adjacent carriages and a track receiver and transmitter for communicating data between the master controller and the microprocessor.

Because a carriage cannot physically overtake another carriage on the single track, a mechanism is provided to automatically transfer control from one carriage to a second carriage, simulating an overtaking process. The interface translator, which is monitoring the positions of all the carriage, provides a means for transferring control information from one carriage to an adjacent carriage as part of a handover process. As an example, if a first carriage is moving along the track and encounters a second carriage, the first carriage is stopped at a minimum buffer distance from the second carriage and the control commands are transferred to the second carriage. When a preset viewing location is requested, the interface translator which stores information relating to viewing locations, instructs the carriage closest to the preset viewing location, thus reducing a response time which is especially important if the preset viewing location is activated by an alarm input. If the carriages are performing tours, which are automated movements of the carriages along the track, the handover process is more complicated. When a first carriage performing a tour encounters a second carriage on the track, tour information which is stored at the interface translator is sent to the second carriage allowing the second carriage to continue the tour. Completion of the handover process occurs as the tour is executed.

The position management software of the interface translator polls each carriage at predetermined time intervals or rate to monitor the location of each carriage. The polling rate of the carriages may change

according to the number of carriages on the track and the number of active or stationary carriages.

According to another form of the invention there is provided a track assembly comprising an insulative insert which engages a conductor at one surface and engages a portion of the track assembly at a second surface whereby the insulative insert function as an insulator of a conductor and a means for attaching a conductor to a track assembly. The insulating insert may have additional insulating members attached to a surface of the insert providing a means for insulating two or more conductors. The additional insulating members are suitably located between two or more conductors. Preferably, the insulation insert contacts the conductor(s) and track assembly at positioned intervals along the track assembly; however, the insulation insert may contact the conductors and track assembly continuously.

Another form of the invention provides surveillance method including the steps of:

locating two or more carriages on a track;

mounting at least one monitoring device on each carriage;

providing power to power movement of each carriage on the track;

transmitting output signals, preferably image or image and audio signals, from the monitoring device to a remote location; and

controlling movement of the carriages on the track.

Throughout this specification unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of the stated integers or group of integers or steps but not the exclusion of any other integer or group of integers.

DESCRIPTION OF THE FIGURES

Preferred embodiments of the invention will now be

described by way of example only with reference to the accompanying drawings in which:

FIG. 1 is a drawing of the general hardware components of a surveillance system;

FIG. 2 is a drawing of a carriage or Video Transport Unit (VTU) attached to a track;

FIG. 3A is an end view drawing of a brush bogie of a VTU comprising brushes for power, data and ground and a Radio Frequency (RF) antenna for transmission of video information;

FIG. 3B is an end view of the brush bogie of FIG. 3A attached to a three conductor track assembly;

FIG. 4A is an end view drawing of a brush bogie of a VTU comprising brushes for power and ground and an RF antenna for transmission of both data and video information;

FIG. 4B is an end view of the brush bogie of FIG. 4A attached to a three conductor track assembly;

FIG. 5 is a plan bottom view of a brush bogie of a VTU as shown in FIG. 3A;

FIG. 6A shows a three conductor track assembly for the video surveillance system;

FIG. 6B shows a two conductor track assembly for the video surveillance system;

FIG. 7 is a diagram of a general overview of the electrical components of the surveillance system;

FIG. 8 shows a block diagram of electrical components of a microprocessor and camera sections of a VTU as in FIG. 7;

FIG. 9 shows a block diagram of electrical components of an interface translator as in FIG. 7;

FIG. 10 shows a block diagram of electrical components of data or control signal flow between a controller and VTU;

FIG. 11 is an electrical diagram of the track interface of FIG.

7;

FIG 12 is an electrical diagram of the VTU interface of FIG. 7;

FIG. 13 shows a diagram of a data polling pattern; and

FIG. 14 shows a flow diagram of a controller request.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, wherein like numerals designate like or corresponding parts throughout the several views of a surveillance system.

Figure 1 shows three carriages or Video Transport Units (VTUs) 12, 13, 14 attached to track 11 in communication with an interface translator 29 via conductors associated with track 11. Interface translator 29 links with a video monitoring system 100 and controller 34 which may be at a remote location. Interface translator 29 links control information between controller 34 and each VTU; receives video information from VTUs and provides this information to video monitoring system 100 in a form suitable for viewing; and provides a means for position management of VTUs as part of a collision avoidance means.

Figure 2 shows a VTU 14 attached to track 11. The VTU includes a driver section 73, a monitoring device section 71 and a microprocessor section 72. Driver section 73 provides a means for moving VTU 14 on track 11. Monitoring device section 71 comprises a mounted video camera 46 which is capable of panning continuously through 360°, tilt 120°, zoom and focus. It will be understood that the video camera is merely one example of a monitoring device which may operate in the visible, infrared or ultraviolet spectrum and which may include audio monitoring. Microprocessor section 72 comprises electronic means for controlling VTU 14, transmitting video information and transmitting and receiving data information to a remote location as shown in figure 1.

Figure 3A shows an end view of a brush bogie 15 in isolation

and figure 3B shows an end view of the brush bogie 15 of figure 3A attached to a track 11 within track assembly 111. Brush bogie 15 electronically links a VTU 14 to track 11. Four wheels 23, composed of plastic or other suitable material, which contact ground conductor 200 at an extended slanted portion enables rolling movement of brush bogie 15 and attaches brush bogie 15 to track 11. A pair of wheels 24 contact ground conductor 200 at a same surface as carbon brushes 205 and provide a force to assure constant and even contact of wheels 23 with extended slanted portions of ground conductor 200. Four spring loaded carbon brushes 205 attached to brush bogie 15 contact ground conductor 200 and provide suitable grounding of VTU 14. A pair of spring loaded carbon brushes 206 transmit power to VTU 14 from power conductor 201. A pair of spring loaded carbon brushes 207 transmit data and control information between microprocessor section 22 and data and video conductor 202. An antenna 208 composed of teflon coated tinned copper or other suitable material transmits video signals from microprocessor section 72 to data and video conductor 202 by RF. An optical encoder 209 comprises a means for measuring rotations of a rotatable wheel for determining speed and distance travelled by VTU 14.

Track assembly 111 comprises a base member 112 with slanting sidewalls 113, a semi-opaque cover 114 which is mountable to slanting side walls 113 and centrally positioned track 11 shown comprising three conductors 200 (ground), 201 (power) and 202 (data and video) and insulator insert 203.

Figure 4A shows an end view of a brush bogie 15A with an RF antenna 208 for transmitting both data and video information to a conductor. Accordingly, carbon brushes for transmitting data signals shown as carbon brushes 207 in figures 3A and 3B are omitted.

Figure 4B shows an end view of the brush bogie 15A of Figure 4A attached to a three conductor track 11 in a similar manner as in figure 3B.

Figure 5 is a bottom plan view of brush bogie 15 as shown in figure 3A. Shown more clearly are RF antenna 208 for transmitting video information, pair of carbon brushes 206 for transmitting power, pair of carbon brushes 207 for transmitting data signals, four carbon brushes 205 for grounding VTU 14 and optical encoder 209. Also shown more clearly is a pair of wheels 24 and four wheels 23 for attaching VTU 14 to track 11.

Figure 6A shows a track assembly 111 for a three conductor track 11 comprising a base member 112 with slanting side walls 113, a semi-opaque cover 114 which is mountable on to slanting side walls 113 and centrally positioned track 11 comprising conductors 200 (ground), 201 (power) and 202 (data and video) and insulator insert 203. Insulator insert 203 is a T-shaped clip with two pairs of barbs 210 on top and two pairs of barbs 211 on bottom sides respectively of insulation insert 203. Perpendicular wall 220 is centrally located along the bottom of insulation insert 203 separating conductors 201 and 202. The two pairs of barbs 210 engage a central base member of track assembly 111 at recesses 18 and 19. The two pairs of barbs 211 engage conductors 201 and 202 on a bottom side of conductors 201 and 202. When in use, insulator insert 203 insulates and attaches conductors 201 and 202 to the central base member of track assembly 111. Track 11 also comprises two opposed ground conductors 200 which form a cross sectional U-like shape in which conductors 201 and 202 are internally located.

Insulation inserts 203 are positioned at intervals along the central base of track assembly 111 to insulate and attach conductors 201 and 202 to track assembly 111.

Figure 6B show a track assembly 312 which is similar to the track assembly of figure 6A; however, track 311 of figure 6B comprises only two conductors 300 and 301. Conductor 301 conducts power, video and data information whereas conductor 300 provides grounding. Insulator insert 303 attaches to conductor 301 and central base member of track assembly 311 at raised recess 18 and 19 in a similar manner as in

figure 6A using barb members on top 310 and bottom 311 of insulator 303.

Figure 7 shows a block diagram overview of the surveillance system. Video and data signals are modulated to different frequencies, combined and transmitted along the track 11 shown as a dual track for power and data and video signals, then separated and processed by either a VTU 14 or interface translator 29. The signal path is bi-directional; data and control signals are transmitted in both directions between VTU 14 and interface translator 29. Video signals are transmitted only in one direction, from VTU 14 to interface translator 29. Provisions for up to eight video signals modulated to different frequencies are provided, but it would be appreciated by one skilled in the art that additional video signals could be used.

The VTU 14 receives and transmits signals to track 11 via VTU interface 40, which may be a mixer and splitter. VTU interface 40 provides a means for receiving and transmitting signals from VTU 14 and track 11. Power flows through the VTU interface 40 from track 11 to VTU 14 to power devices such as a driver motor on driver section 73 and camera 46 on monitoring device section 71. Video signals from a camera 46 pass through video transmitter 43 to provide the video signals in a suitable form to be transmitted on to track 11 by VTU interface 40. VTU interface 40 also receives and transmits data or control signals to and from data transceiver 44. Data transceiver 44 provides electrical signals in a suitable form for micro-controller 48. Data transceiver 44 also provides information from micro-controller 48 to VTU interface 40 in a suitable form for transmission on track 11. Micro-controller 48 is a microprocessor controlling the functions of VTU 14 including position management and camera functions.

At a remote control station, a user may control a VTU by inputing commands at controller 34 which sends signals to interface translator 29 which comprises: track interface 21, data transceiver 28, micro-controller 32, RF splitter 21A, video receiver 22 and video

demodulator 25 which sends a suitable video signal for viewing at video monitoring station 100. Figures 9 and 10 provide additional information relating to interface translator 29 as discussed below. Micro-controller 32 sends signals to data transceiver 28 which communicates with track 11 through track interface 21. Track interface 21 is also linked to RF splitter 21A and DC power supply 70. RF splitter 21A is attached to a video receiver 22 which is further linked to a video demodulator 25 and a monitor 100 for viewing images originating from camera 46.

The characteristic impedance of dual track 11 is approximately 22 ohms. Track 11 has a track terminator 11A at an end opposite to track interface 21 to reduce signal reflections which may cause video picture distortion. VTUs are designed to appear as high impedance to avoid video and data signals from being loaded with multiple VTUs on track 11.

Figure 8 shows a block diagram of the power and signal processing schema of the invention. A camera 46, mounted on monitoring device section 71, is controlled by microprocessor 48 for viewing of an area under surveillance. The microprocessor 48 is able to rotate, pivot, zoom and focus the camera 46.

Video signals from the camera 46 are processed by video modulator 45 for transmission by video transmitter 43. The video modulator encodes the video signals for a suitable carrier frequency. As described below, this may be an RF signal for brushless contacts or a lower frequency in embodiments that use brush contacts.

VTU interface 40, which may comprise a filter and mixer, manages the placing of signals on the track 11 and receiving signals from the track 11. Power supply 42 is also transferred from track 11 to the VTU via VTU interface 40.

The microprocessor 48 also controls the movement of the VTU 14 by controlling the servo control 49 on the driver section 70. Control of the VTU may originate from a user at a remote station with a

controller 34. As described below, an interface translator 29 transmits control signals on track 11. The control signals are picked up by VTU interface 40 and communicated to data transceiver modulator and demodulator 44. Data transceiver modulator and demodulator 44 is connected to driver 47 which is connected to a microprocessor 48 which controls both the camera 46 and servo control 49.

Figure 9 shows an interface translator 29 comprising track interface 21 connected directly to track 11. Track interface 21 is connected to video receivers 22, 23, 24 which receive video signals originating from each VTU. Video signals are transmitted at different frequencies for each VTU. The video signals are demodulated by a respective demodulator 25, 26, 27 which is hard wired to monitoring system 100 which includes a video display whereby images from each camera 46 of each VTU can be displayed.

A power supply 70 is connected to track interface 21 and may be a stand alone battery unit or connected to a remote power source through conductor 201.

Track interface 21 is also connected through a data transceiver modulator and demodulator 28 and driver 31 to controller 34 for controlling a VTU from a remote location.

Figure 10 shows data and control signal flow between controller 34 to VTU 14 via interface translator 29. Data and control information flows in both directions between controller 34 and VTU 14. Interface translator 29 includes a driver 31 connected to a microprocessor 32. The microprocessor 32 includes a communication and positional manager, protocol translator and memory 33. Data transceiver 28 shown as "modulated track data" modulates data and sends the modulated data to track interface 21 or receives signals from track interface 21 and demodulates the signals. Signals are transmitted to and received from track 11 by VTU interface 40, shown as a mixer and launching circuit. Signals received from track 11 by VTU interface 40 are demodulated by

data transceiver 44 shown as "modulated track data". Signal originating from VTU 14 are modulated by data transceiver 44 before placing onto track 11 by VTU interface 40. Data transceiver 44 is attached to microprocessor 48 which can store data information in memory 48A.

Figure 11 is an electronic diagram of a track interface 21 as shown in figure 7. Track 11 is shown as a dual track with DC power and RF signals on separate conductors. At the interface translator 29, signals from the track 11 are band pass filtered 400 between 7 MHz and 270 MHz to remove as much brush, motor and other interference as possible. The track impedance is transformed back to 75 ohms and video and data signals are separated using directional couplers 401A and 401B. Two video paths 402A and 402B are provided for multiple VTU applications. These two video paths are split into four thus providing eight video channels. The video channels are band pass filtered 403A and 403B between 100 MHz and 275 MHz to cover the eight video channels before passing to a video receiver. The data signal is low pass filtered 404 to 13 MHz to remove video signals before passing to a data transmitter and receiver. A low pass filter 405 filters data and video signals on DC track.

Figure 12 is an electronic diagram of a VTU interface 40 as shown in figure 7. The output impedance of the video transmitter is 75 ohms. The video signal passes through a high pass filter 500 to an antenna loop which is terminated in 75 ohms. The antenna loop directionally launches a signal onto the track 11, sending most of the signal towards the interface translator 29.

The data transmitter modulates data to 10.7 MHz. The transmitted data passes though a band pass filter between 7 and 13 MHz, shown as filters 501 and 502, to remove the video signals and other interference from track 11. The signal passes through a matching transformer 503 which raises the impedance to approximately 320 ohms. This reduces the loading of multiple VTUs on track 11.

Track 11 is shown as a dual track with three conductors for

DC power, ground and RF signals on separate conductors. The DC track has a low pass filter 504.

Collision Avoidance Means

In one form of the invention, track 11 has multiple VTUs 12, 13, 14 which are movable along overlapping locations of track 11. Accordingly, it is important to prevent collisions between adjacent VTUs.

A positional management system provides a means to prevent collisions between adjacent VTUs. Two means of collision avoidance are provided, a first main or master level controlled by an interface translator 29 and a second means managed by each VTU.

Figures 7, 9 and10 show interface translator 29 comprising a microprocessor 32 which provides an interface between master controller 34 and data transceiver 28. Hardware and software within interface translator 29 control movement of each VTU 12, 13, 14. Interface translator 29 is located in a Power Supply Interface enclosure mounted at the start of each track 11.

The interface translator 29 interprets and processes commands received from master controller 34 and forwards the commands to an appropriate VTU 12, 13, 14. Interface translator 29 manages positional and movement commands of each VTU and allocates priority to an appropriate VTU in response to an alarm activated preset or other command.

Presets are a mechanism where positional information about a camera view is automatically stored so a VTU can return to that position later. Presets can be used with alarms to view particular areas where activity has set off the alarm. The interface translator 29 monitoring the system decides which VTU 12, 13, 14 is closest to the preset position requested and enables the shortest response time and enures movement of a VTU is unimpeded by other VTUs on track 11.

Interface translator 29 also functions as a main positional

manager for a track 11 to which it is attached. Positional information is provided from data sent by each VTU 12, 13, 14 on track 11 and this information is mapped in memory 33. Each VTU 12, 13, 14 comprises an optical encoder 209 (shown in figure 3) which measures distance by wheel rotations as the VTU moves along track 11. Position indicators or registration marks, such as bar codes, along track 11 and markings on the measurement wheel are monitored by a sensor which transmits signals to microprocessor 48 which is then able to store data on the position of each VTU 12, 13, 14. As VTU 12, 13, 14 moves along track 11, memory in microprocessor 48 is updated so that microprocessor 48 is continually aware of each VTU 12, 13, 14 location on track 11. Interface translator 29 acts as an arbitrator if there is conflict of position requests and ensures that adjacent VTUs maintain a minimal distance. A suitable minimal distance is 2.4 metres or 8 feet which forms a buffer zone between any adjacent VTUs.

Referring to figures 7, 8 and 10, while microprocessor 48 records the position of its own VTU 14, it is also transmitting data on its location through driver 47, data transceiver 44 and VTU interface 41 along a common communication conductor 202 of track 11 where interface translator 29 is able to receive this positional data through track interface 21 and data transceiver 28 for processing by its microprocessor 32.

Because each VTU is effectively identical, they are each able to store data on the location of their own VTU along track 11 and are equally able to transmit this data on the common communication conductor 202 of track 11 where this data can be received by the interface translator 29. During installation, VTUs are configured with appropriate positional information of other VTUs. This information is continually updated during VTU movement on track 11. An active VTU broadcasts its changing location which allows other VTUs to update a last known location of adjacent VTUs. The active VTU will immediately stop if conflict arises with an adjacent VTU location.

Transmission of data from each VTU occurs on a common frequency. Accordingly, because there is only one communication line 202 which is used by all VTUs, interface translator 29 operates to ensure that only one VTU transmits data at any one time.

Position management software of interface translator 29 sequentially polls each VTU. The polling process occurs continually even if there is no movement or activity of any one VTU 12, 13, 14 on track 11. Each VTU 12, 13, 14 has a unique address. Interface translator 29 addresses each VTU 12, 13, 14 in turn and requests the positional information and status of each VTU. The VTU 12, 13, 14 which recognises this unique address is the only VTU which responds to a command from interface translator 29. The response from the commanded VTU 12, 13, 14 contains its current positional information and status. The rate at which each VTU and its unique address is polled is dependent upon the number of VTUs on track 11. This polling rate is typically one to two per second. If the information translator 29 detects an active status on any VTU during the normal polling routine, it immediately increase the polling rate to the active VTU. This process is called refresh. The rate at which refresh occurs is directly related to the number of active or moving VTUs on track 11 at any one time. A typical refresh rate is 6 to 10 per second.

Information which is returned by a particular VTU 12, 13, 14 during refresh allows the interface translator 29 to update the last known location of the active VTU at a more frequent rate.

Figure 13 shows a typical data polling pattern 600 comprising poll 601 and reply data 602. The poll data 601 comprises a preamble 607 followed by 13 characters 603 of information. Each character comprises a start 604, stop 605 and eight bits of data 606. Time from start to stop is approximately 1.0 msec.

As shown in figures 7 to 10, when it is desired to monitor a particular location, master controller 34 transmits command signals to the

interface translator 29. The interface translator 29 has a record of the location of each VTU stored in its memory 33. Consequently when one particular area must be monitored its selects the closest VTU to move to a location on track 11 where monitoring can occur. Accordingly, as part of the process of commanding one of the VTUs to move, it must first allocate priority to each VTU 12, 13, 14 according to its distance along track 11 from the final destination along track 11 where monitoring is to occur. If there is any positional conflict between VTUs because they are both within a similar distance from the desired destination, the interface translator 29 ensures that adjacent VTUs do not encroach on a buffer zone which has been preselected and stored in memory. It follows therefore that if two VTUs move to a desired destination and cannot reach the final destination because they both would enter the buffer zone between them, the VTU with the higher priority would be instructed to move to the desired destination while the adjacent VTU with the lower priority would move away from the desired destination to ensure the buffer zone is maintained.

In addition to the above, each VTU and its microprocessor 48 stores data in memory 48A, including the address on the position of each other VTUs 12, 13, 14 on track 11. Microprocessor 48 is also able to receive data transmitted by other VTUs 12, 13, 14 along the common communication conductor 202 of track 11. Because each VTU 12, 13, 14 is aware of the location of other VTUs on track 11 an active VTU 12, 13, 14 will immediately stop if the positional data it has stored on adjacent VTUs indicates that a conflict has arisen because the moving VTU 12, 13, 14 has entered a buffer zone. Accordingly, if the moving VTU finds that it is within a buffer zone of an adjacent VTU it immediately stops. The interface translator 29 then is able to issue commands to the conflicting VTUs 12, 13, 14 so that the VTU 12, 13, 14 allocated the highest priority can move to the desired destination while the other VTU 12, 13, 14 moves far enough away so that the buffer zone is maintained.

When a VTU approaches a buffer zone between itself and a

second VTU, information and commands may be transferred from one VTU to a second VTU as part of a handover or swapping procedure. Handover procedures are controlled by interface translator 29.

As part of the collision avoidance system, position indicators provided as bar codes are located along the track at intervals to provide reference points for correcting any discrepancies which may occur due to loss of power or optical encoder 209 inaccuracies. The bar codes may provide an absolute measurement of distance along track 11. These bar codes are sensed by bar code detectors located on each VTU 12, 13, 14. Initially, each VTU is moved along track 11 at a slow speed to set bar code locations into memory. Initial referencing of bar code locations at slow speed assures more accurate position identification as wheels 23 and 24 of the VTUs are less likely to slip when compared to the higher speed of movement which is typically 3.3 metres/second to 4.5 metres/second, although speed of movement may be faster or slower than this range. The bar code detectors and the optical encoder 209 together provide positional data to the microprocessor 48 of its VTU 12, 13, 14.

With the collision avoidance system described above, a fail safe positional management system is achieved for each of VTUs 12, 13, 14, whereby the interface translator 29 is able to manage position and movement commands from the master controller 34 and allocate priority to the appropriate VTU 12, 13, 14 to satisfy such requests as alarm activated presets and tours. The interface translator 29 is able to act as an arbitrator if there is a conflict of position requests received from the master controller 34. The interface translator 29 ensures that adjacent VTUs 12, 13, 14 do not encroach on the buffer zone. If for some reason this policing action by interface translator 29 is interrupted there is still a second level of collision avoidance provided by VTUs 12, 13, 14 monitoring the position of other VTUs 12, 13, 14 on track 11.

Positional data on each VTU 12, 13, 14 is mapped into separate memory locations allocated with the specific address of a

respective VTU 12, 13, 14. A similar mapping process occurs in storage locations of the microprocessor 48 of each of the VTUs 12, 13, 14. Each of the microprocessors 48 of the VTUs 12, 13, 14 also stores data on the buffer zone with the result that each microprocessor 48 can determine when its VTU 12, 13, 14 is in conflict with an adjacent VTU 12, 13, 14. Unlike the interface translator 29, however, microprocessor 48 of each VTU 12, 13, 14 does not have the ability to solve a conflict with an adjacent VTU 12, 13, 14.

Figure 14 shows a typical flow diagram of a controller request received from the master controller 34. Master controller 34 requests a VTU 12, 13, 14 to move forward by sending a command signal 50 to interface translator 29 which receives the request 51. The interface translator 29 then interprets and processes the request 52. The interface translator 29 then determines whether the command is valid 53. If the command is not valid then further action is stopped 54.

If all the position parameters of each VTU is maintained, the interface translator 29 transmits a forward command 55 to one of the VTUs.

A VTU receives a forward command, acknowledges and processes the command 56 from the interface translator 29 and is also constantly listening for updated positional data broadcast 57 transmitted from other VTUs on track 11.

Movement of the VTU is then initiated and positional updates are continuously broadcast 58 from the moving VTU to the common communication conductor 202 of track 11.

Adjacent VTUs receive the broadcast 59 from the moving VTUs and thus update their own records to maintain the most recent data on the position of each VTU on track 11.

The microprocessor 48 of the moving VTUs constantly monitor whether the command from the information translator 29 is current 60.

If the command is current, the VTU repeats the step 56. If the command is not current then the VTU stops 61.

The surveillance system described above provides cameras 46 of a VTU 12, 13, 14 capable of panning continuously through 360°, tilt 240°, zoom and focus. VTU 12, 13, 14 provides linear movement for the camera 21 along track 11 and continuous monitoring of multiple areas within a monitored zone is possible using the unique collision avoidance system described above. A wireless radio frequency antenna 208 is capable of transmitting video and/or data information to a conductor extending along track 11. The above surveillance system provides a means to view multiple areas simultaneously.

It is understood that the invention described in detail herein is susceptible to modification and variation, such that embodiments other than those described herein are contemplated which nevertheless falls within the broad spirt and scope of the invention.

CLAIMS

1. A surveillance system comprising:

an electrical conducting track;

two or more carriages movable on said track;

a driving means mounted on each said carriage for moving each said carriage to different locations along said track;

a power supply providing power to each said carriage;

at least one monitoring device mounted on each said carriage providing an output signal for a monitored location;

a modulation means receiving said output signal;

a transmission means for transmitting modulated output signals on said track;

a means for receiving and demodulating said transmitted modulated output signals;

a viewing means to view said demodulated output signal at a remote location; and

a control means for controlling movement of each said carriage on said track.

2. The system of claim 1 wherein said track comprises three conductors; one conductor for transferring power, a second conductor for transferring video and control signals and a third conductor as ground conductor.

3. A system of claim 1 wherein said carriages transmit output video signals at a predetermined frequency which frequency is different from the predetermined frequency of other carriages.

4. A system of claim 1 wherein said carriages receive and transmit data and control signals at a predetermined frequency which is the same frequency for each said carriage.

5. A system of claim 1 wherein said transmission means is an antenna.

6. A system of claim 5 wherein said antenna transmits

data and/or video information by radio frequency.

7. The system of claim 1 wherein said monitoring device operates in the visible, infrared, or ultraviolet spectrum.

8. The system of claim 1 wherein said monitoring device is a video camera.

9. The system of claim 1 wherein said monitoring device operates in the audio range.

10. The system of claim 1 wherein said control means includes means for avoiding collision of said carriages.

11. The system of claim 10 wherein said means for avoiding collision comprises:

a location means to determine a location of each said carriage on said track;

a transmission means associated with each said carriage for transmitting said carriage position;

a receiving means for receiving and monitoring said positions of each carriage; and

a means for controlling said position of each said carriage to avoid collision of any said carriages.

12. The system of claim 11 further comprising:

means at a remote location for receiving and storing said positions of each carriage;

means for tracking positions of each said carriage; and

means for controlling movement of said carriages to avoid collision.

13. The system of claim 11 further comprising:

means on each carriage for receiving and storing a position of each adjacent carriage;

means on each said carriage for tracking positions of each said adjacent carriage; and

means for controlling movement of said carriages to avoid

collision.

14. The system of claim 11 wherein said location means comprises a position sensor on said carriage.

15. The system of claim 11 wherein said location means comprises a position sensor on said carriage and said position sensor comprises a means for sensing distance travelled by said carriage over a predetermined time period and a means associated with each carriage for calculating a location of said carriage.

16. The system of claim 11 wherein said location means comprises a position sensor on said carriage and said position sensor comprises a rotatable wheel, whereby rotation of the wheel represents the distance travelled by the carriage.

17. The system of claim 11 further comprising registration marks associated with said tracks for correcting said location.

18. The system of claim 1 further comprising means for preventing any one carriage located on said track from colliding with an adjacent carriage located on said track including an interface translator which is adapted to receive position data from said carriages and store the position of each carriage based on the position data received from said carriages.

19. The system of claim 18 further comprising a carriage monitor means which correlates data received from a position sensor on each said carriage and registration marks along said track to store a position of each carriage at a particular instant of time.

20. The system of claim 18 wherein said interface translator comprises a data processing means which comprises position management software for storing data relating to the position of each carriage on said track and controls movement of each carriage whereby collisions between adjacent carriages are avoided.

21. The system of claim 18 wherein said interface translator provides a means for transferring control information from one

carriage to an adjacent carriage.

22. The system of claim 1 further comprising position management software that maintains a minimum distance between adjacent carriages.

23. The system of claim 22 wherein said position management software provides a means for allocating a priority value to each carriage at a particular time, whereby a carriage allocated a higher priority is commanded by said position management software to move to a predetermined location on said track when said interface translator receives a command signal from a master controller.

24. The system of claim 1 wherein said control means comprises a master controller which is connected electrically to an interface translator; said interface translator including a microprocessor controlled by position management software; memory storage means for recording position of each carriage and a minimum distance permitted between adjacent carriages; and a track receiver and transmitter means for communicating data between the master controller and the microprocessor wherein said position management system controls carriages to maintain said minimum distance.

25. The system of claim 24 wherein said position management software comprises a polling means for polling each carriage at a predetermined rate to monitor the location of each carriage and an interface translator with means for changing said polling rate of carriages depending upon whether a carriage is moving or stationary or according to the activity of one or more carriages.

26. The system of claim 1 wherein each carriage includes data processing means for recording and storing data relating to a location of said carriage along said track and for transmitting data relating to said carriage's position along said track to an interface translator.

27. The system of claim 26 wherein said data processing means is capable of receiving and storing data relating to the position of

each adjacent carriage from said interface translator and/or each adjacent carriage.

28. A collision avoidance means for a surveillance system comprising two or more movable carriages on a single track, said collision avoidance means comprising:

means on each carriage for determining a position of said carriage;

means for transmitting said position;

means associated with each said carriage for storing said position and receiving and storing a position for one or more adjacent carriages;

means for controlling movement of said carriage to avoid moving said carriage to a position recorded as the position of the said adjacent carriage.

29. The collision avoidance means of claim 28 wherein said means for determining a position is a position sensor comprising a means for sensing distance travelled by said carriage over a predetermined time period and a means associated with each carriage for calculating a location of said carriage.

30. The collision avoidance means of claim 28 wherein said means for controlling movement prevents said carriage from moving within a predetermined distance of said position recorded as the position of the said adjacent carriage.

31. A track assembly for a system of claim 1 comprising at least one conductor adapted to support a carriage and an insulative insert supporting said track.

32. The track assembly of claim 31 wherein said insulative insert for said track assembly comprises:

a top portion with at least one upstanding barb portion adapted to engage a recess of an insert receiving portion of a conductor, whereby removal of said insert is prevented by said barb portion engaging

said respective recesses; and

a bottom portion comprising at least one upstanding barb portion adapted to engage a recess of an insert receiving portion of a track, whereby removal of said insert is prevented by said barb portion engaging said respective recesses.

33. The track assembly of claim 31 comprising two signal conductors and a ground conductor wherein said insulating insert comprises an additional insulating member centrally located perpendicular to said top portion of said insert positioned between said two signal conductors.

34. A surveillance method including the steps of:

locating two or more carriages on a track;

mounting at least one monitoring device on each said carriage;

providing power to power movement of each said carriage on said track;

transmitting output signals from said monitoring device to a remote location; and

controlling movement of said carriages on said track.

35. The surveillance method of claim 34 wherein said output signals are image signals.

36. The surveillance method of claim 34 wherein said output signals are image and audio signals.

37. The surveillance method of claim 34 further including the steps of:

recording a position of each said carriage on said track; and

controlling movement of said carriages to avoid collision.

38. The surveillance method of claim 34 further including the steps of:

reading registration marks associated with said tracks; calculating a position of each carriage relative to said registration marks;

transmitting said position of each carriage receiving said positions of each carriage; and

controlling movement of each said carriage to avoid collision of any said carriages.

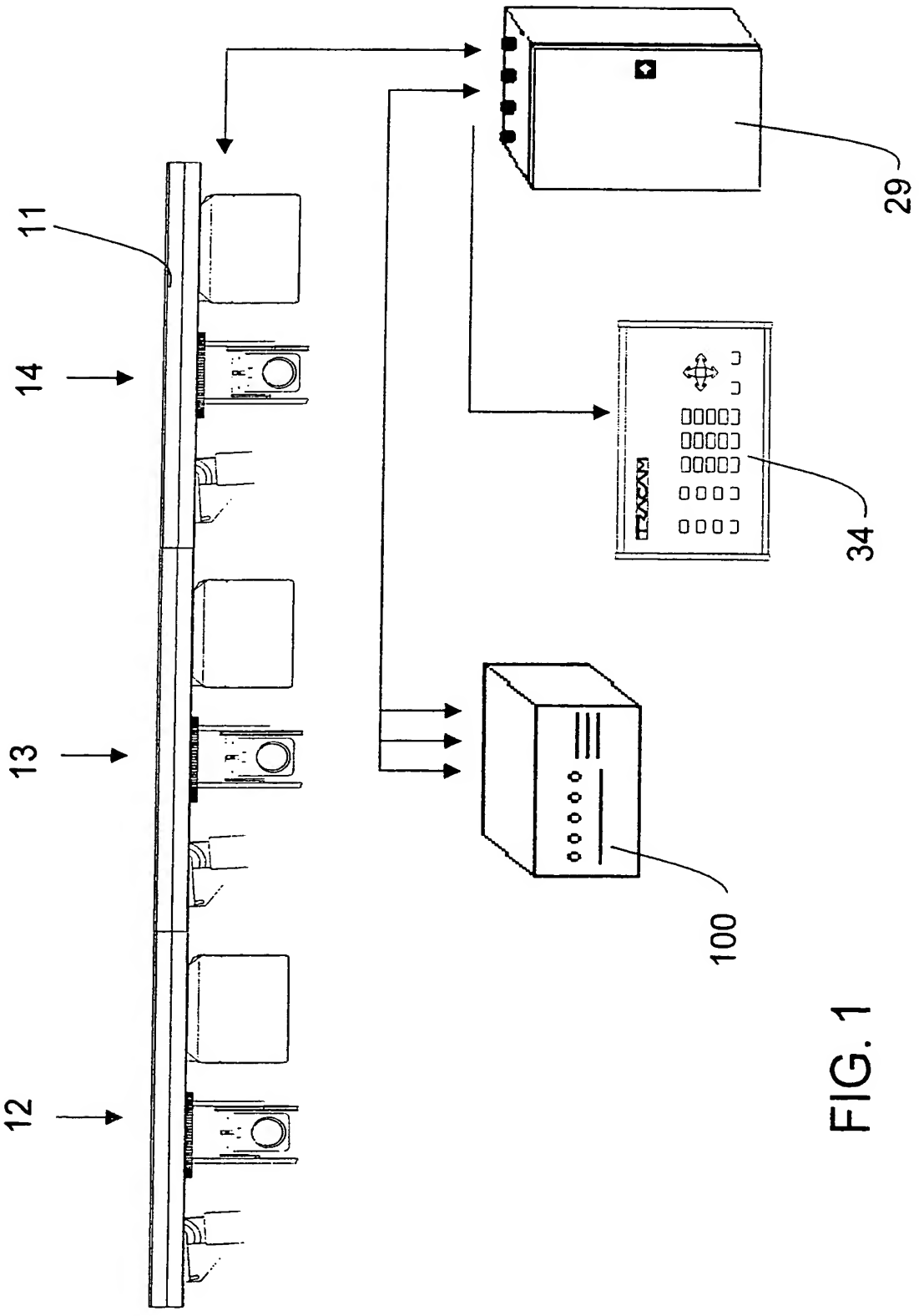

FIG. 1

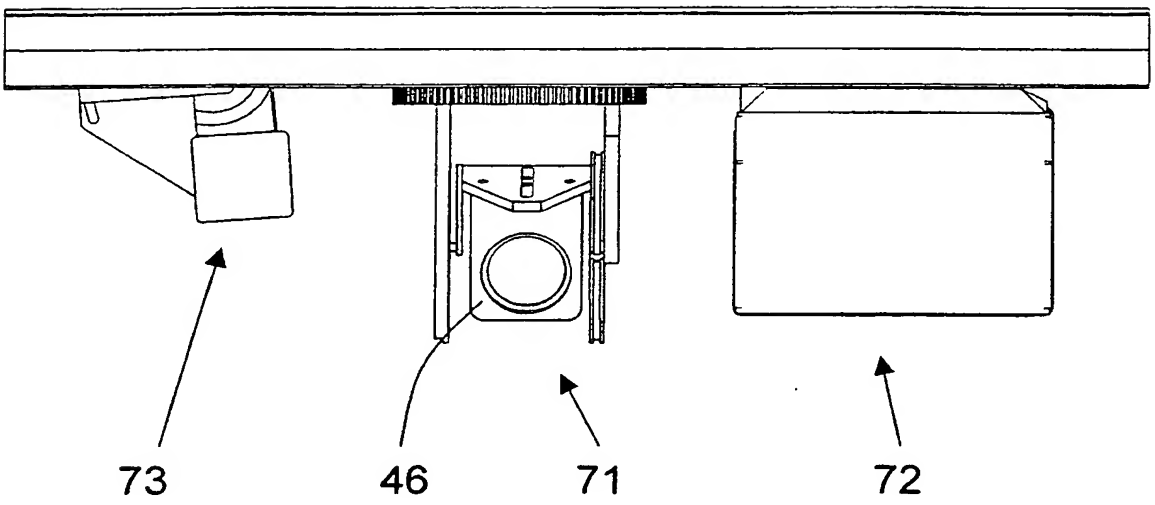

FIG. 2

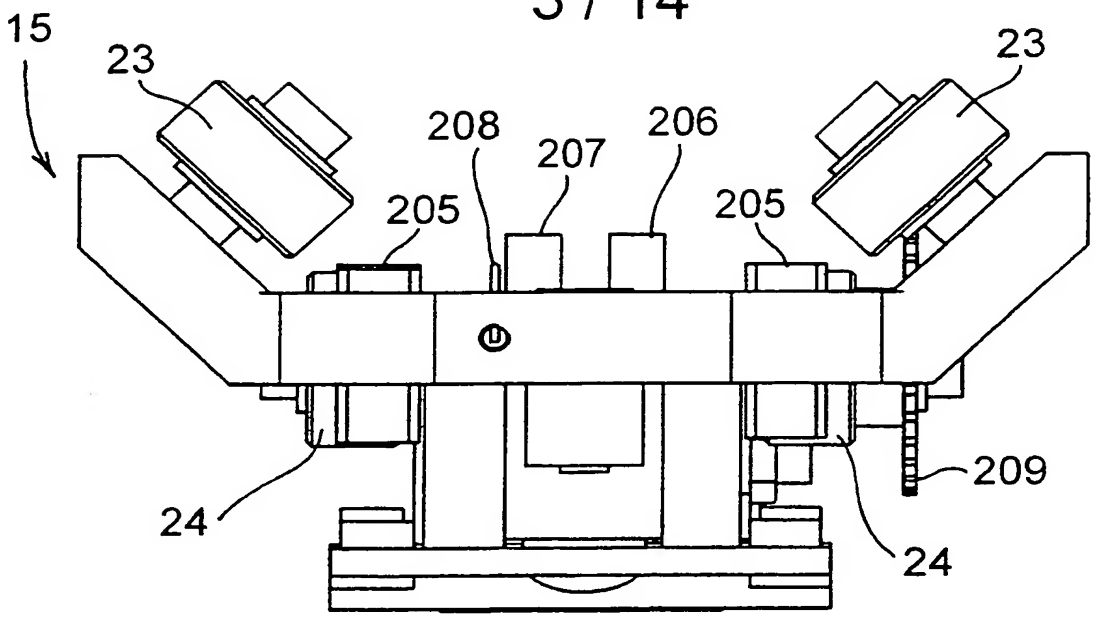
15
23
23
208
207
206
205
205
209
24
24

FIG. 3A

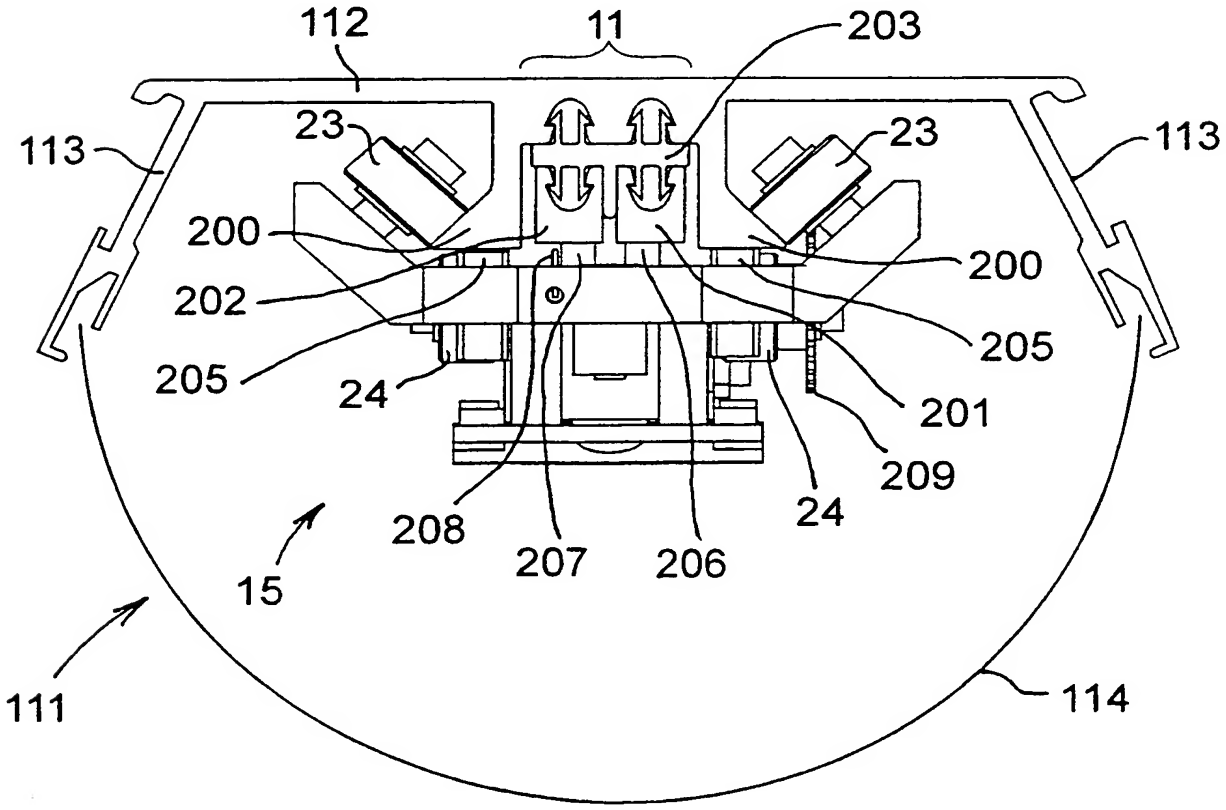
112
11
203
113
23
23
113
200
200
202
205
205
24
201
209
208
207
206
24
15
111
114

FIG. 3B

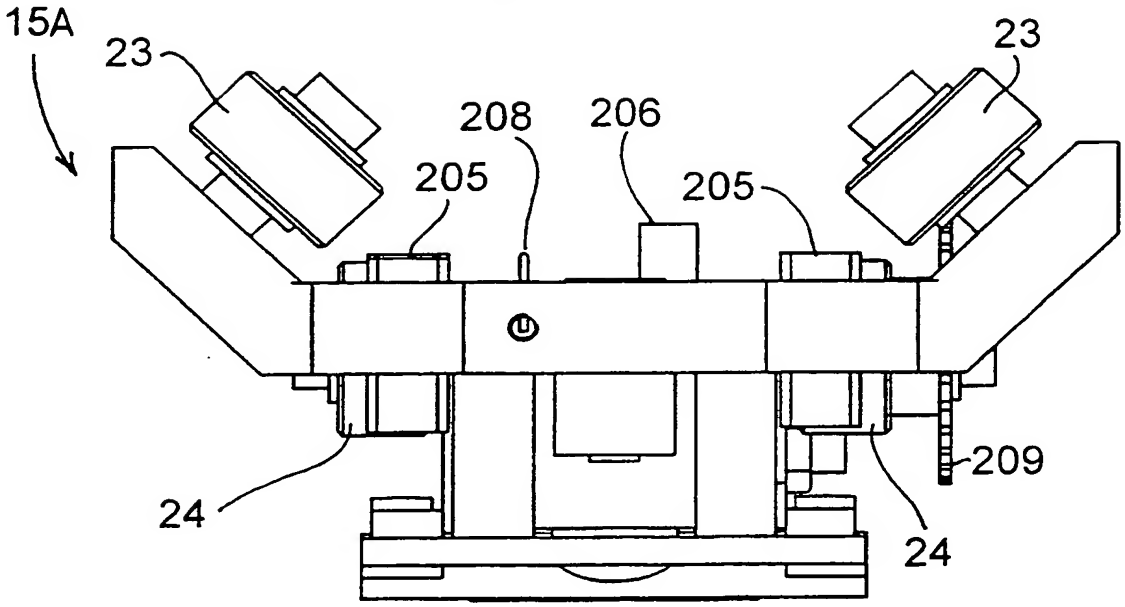
15A
23
23
208
206
205
205
209
24
24

FIG. 4A

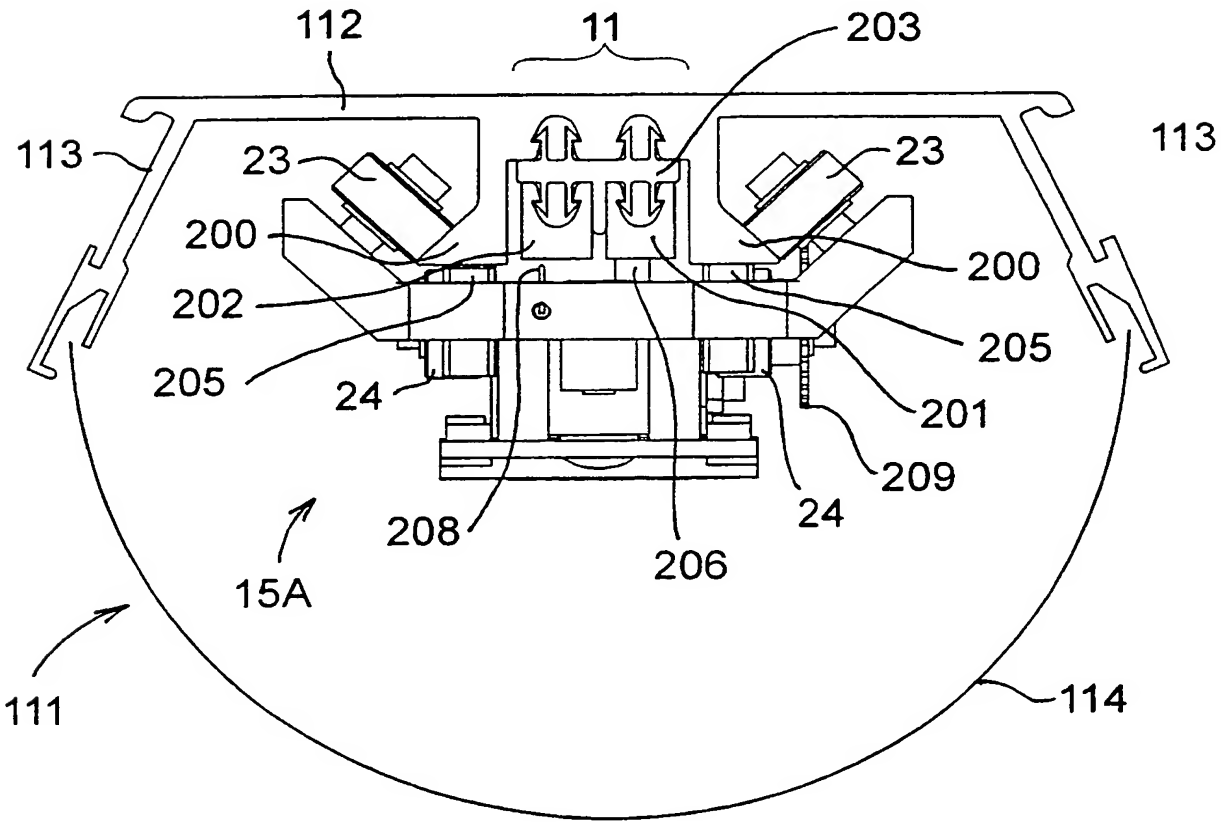
112
11
203
113
113
23
23
200
200
202
205
205
24
201
209
24
208
206
15A
111
114

FIG. 4B

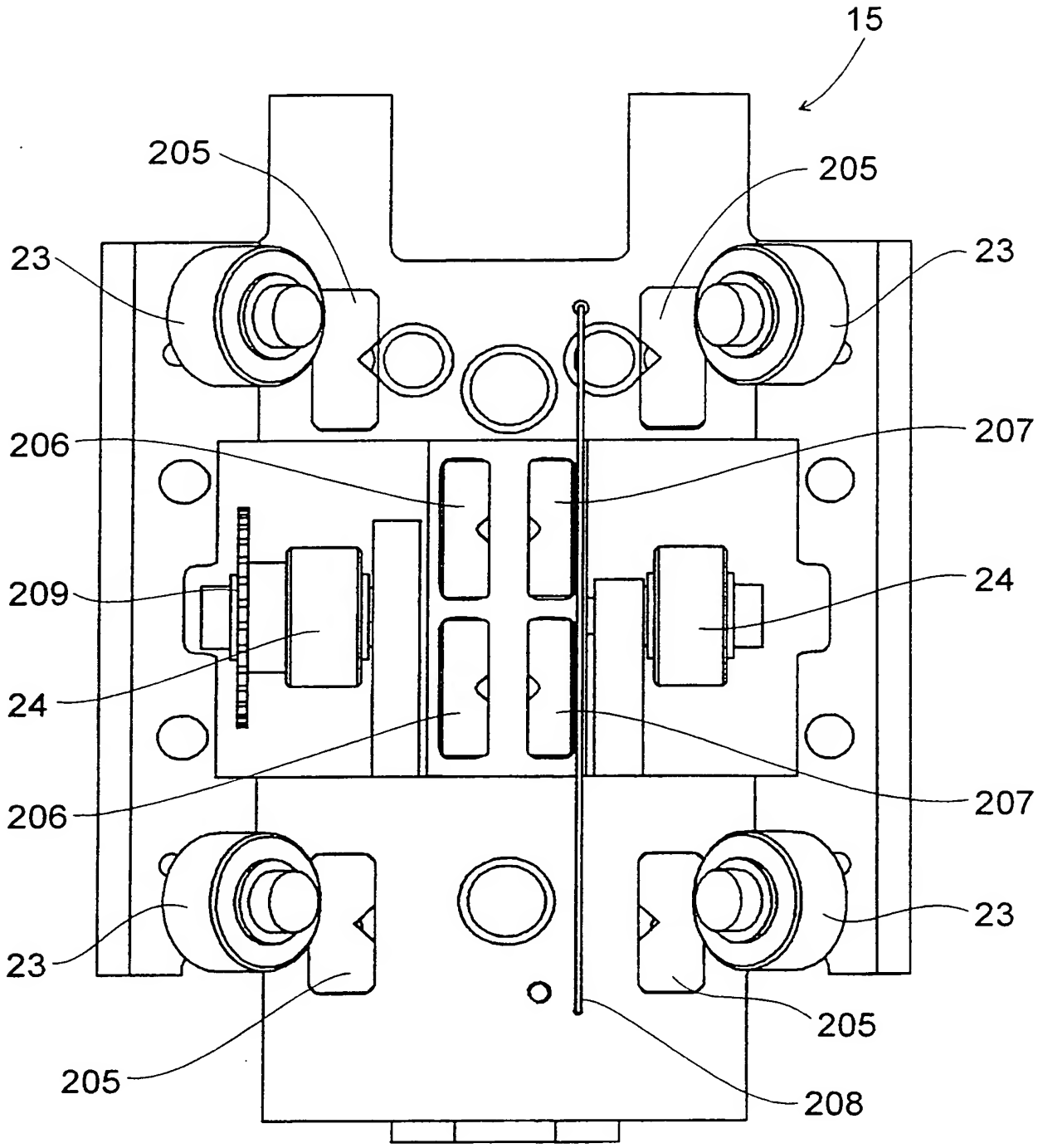

FIG. 5

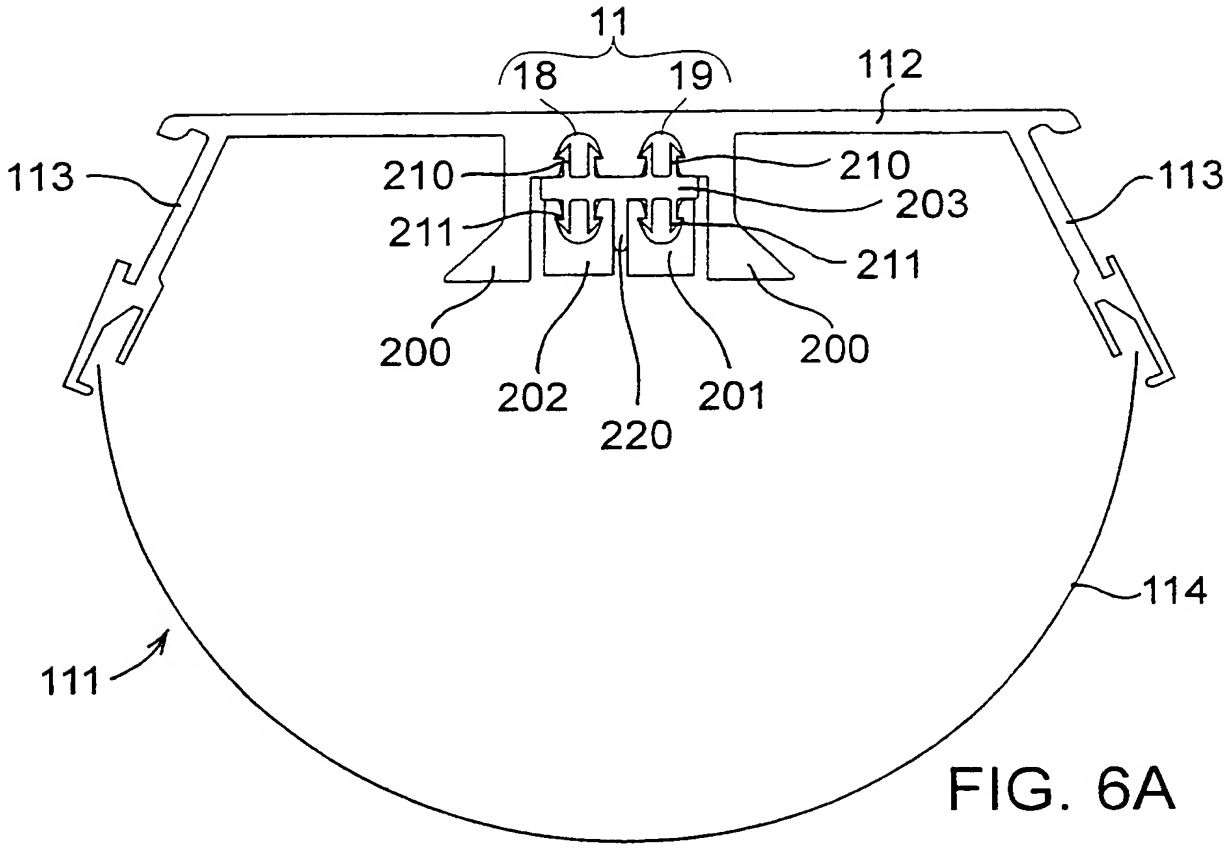
11
18
19
112
113
210
210
203
211
211
113
200
202
220
201
200
114
111

FIG. 6A

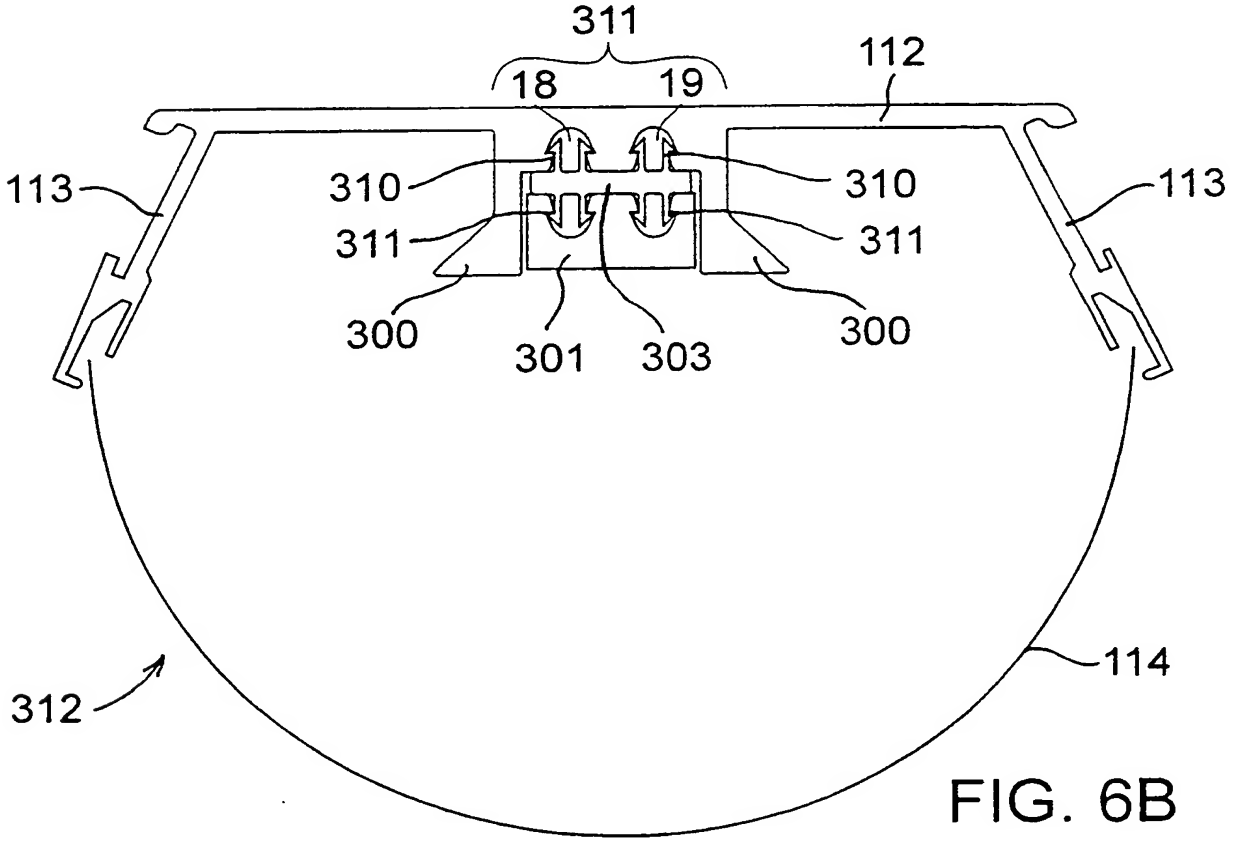
311
18
19
112
113
310
310
311
311
113
300
301
303
300
114
312

FIG. 6B

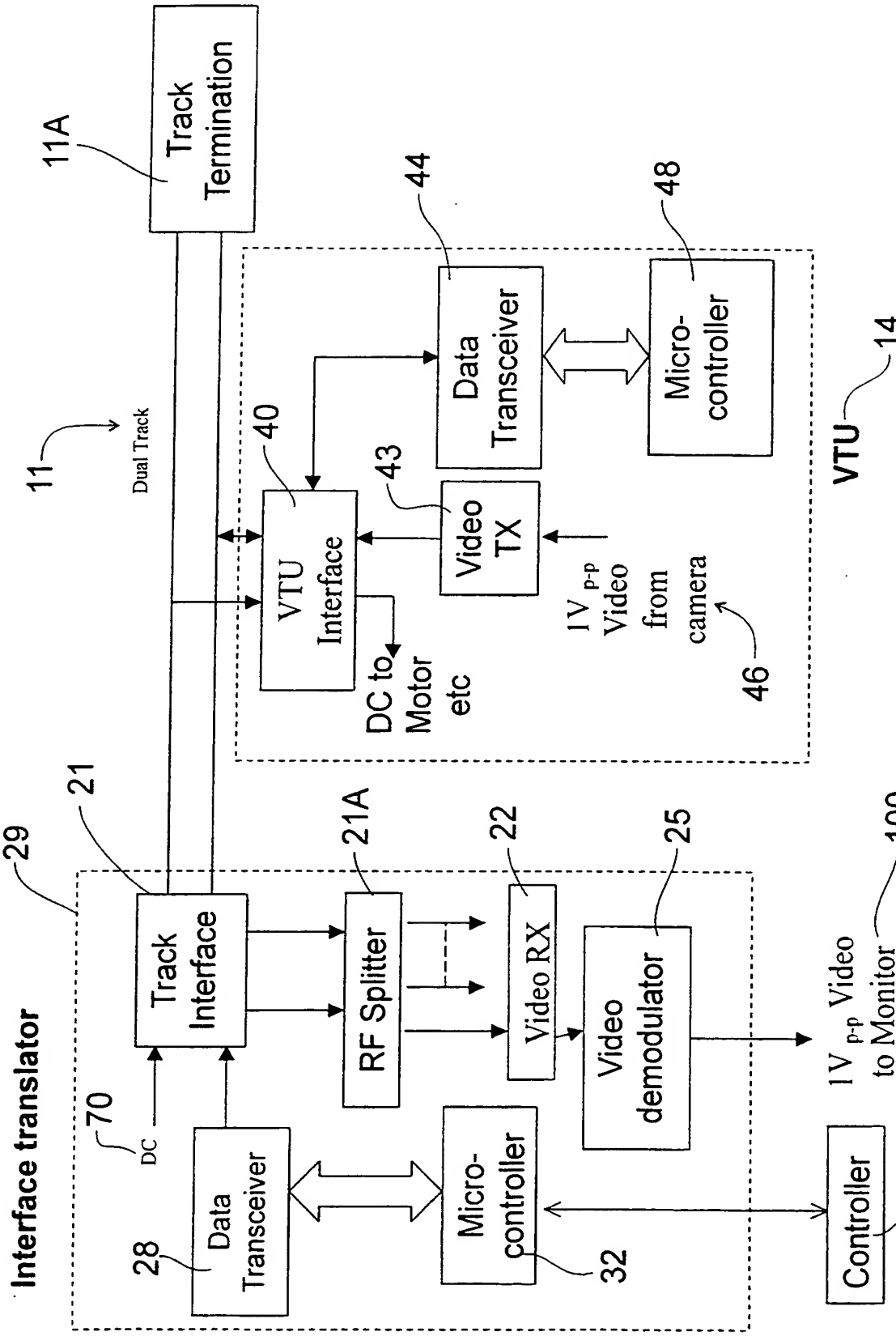
Track Termination
11A
Dual Track
11
Data Transceiver
44
Micro-controller
48
VTU
14
40
43
VTU Interface
Video TX
DC to Motor etc
1V p-p Video from camera
46
21
29
21A
22
25
100
Track Interface
RF Splitter
Video RX
Video demodulator
1V p-p Video to Monitor
Interface translator
70
DC
Data Transceiver
28
Micro-controller
32
Controller
34

FIG. 7

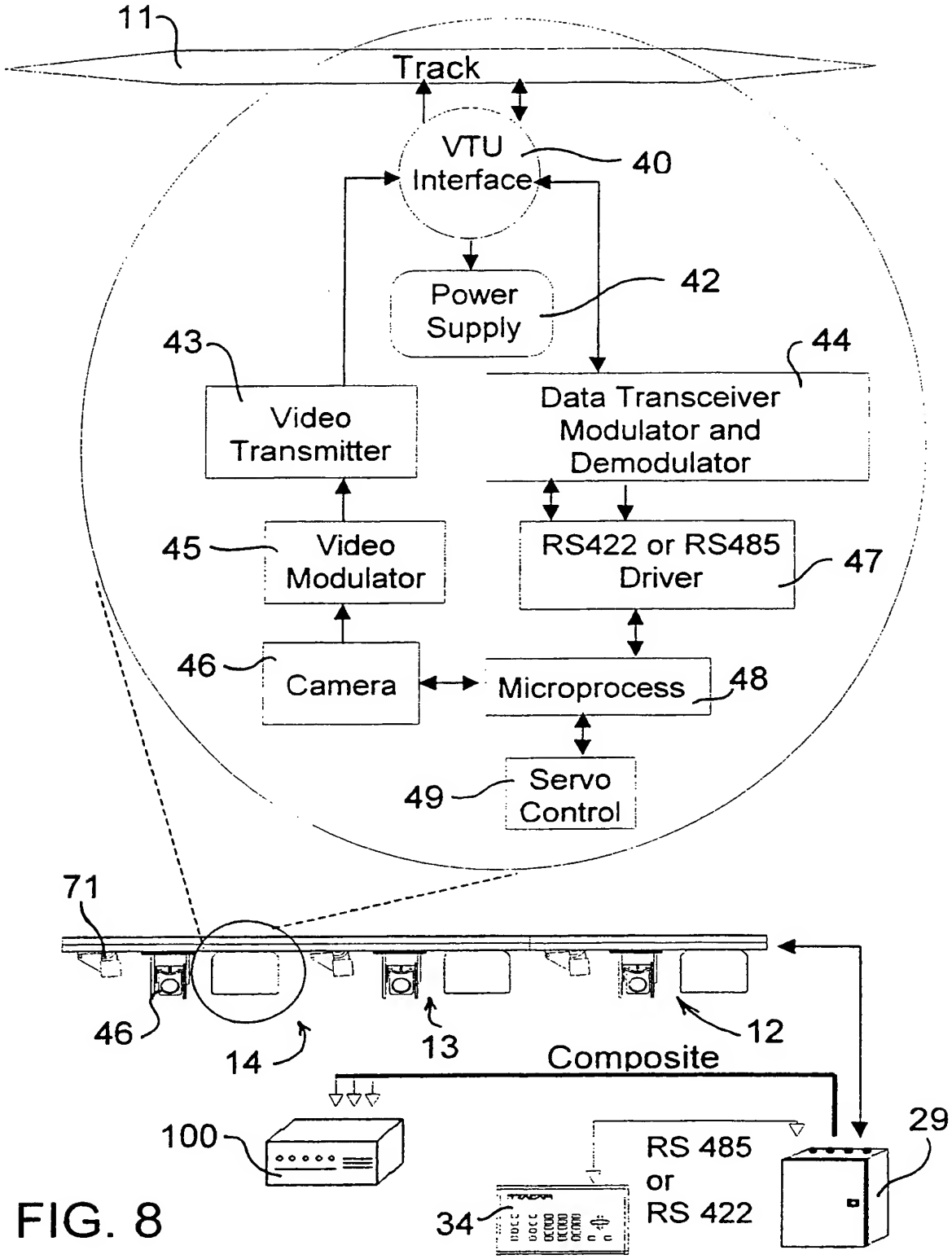
11
Track
VTU Interface
40
Power Supply
42
43
44
Video Transmitter
Data Transceiver Modulator and Demodulator
45
Video Modulator
RS422 or RS485 Driver
47
46
Camera
Microprocess
48
49
Servo Control
71
46
14
13
12
Composite
100
RS 485 or RS 422
29
34

FIG. 8

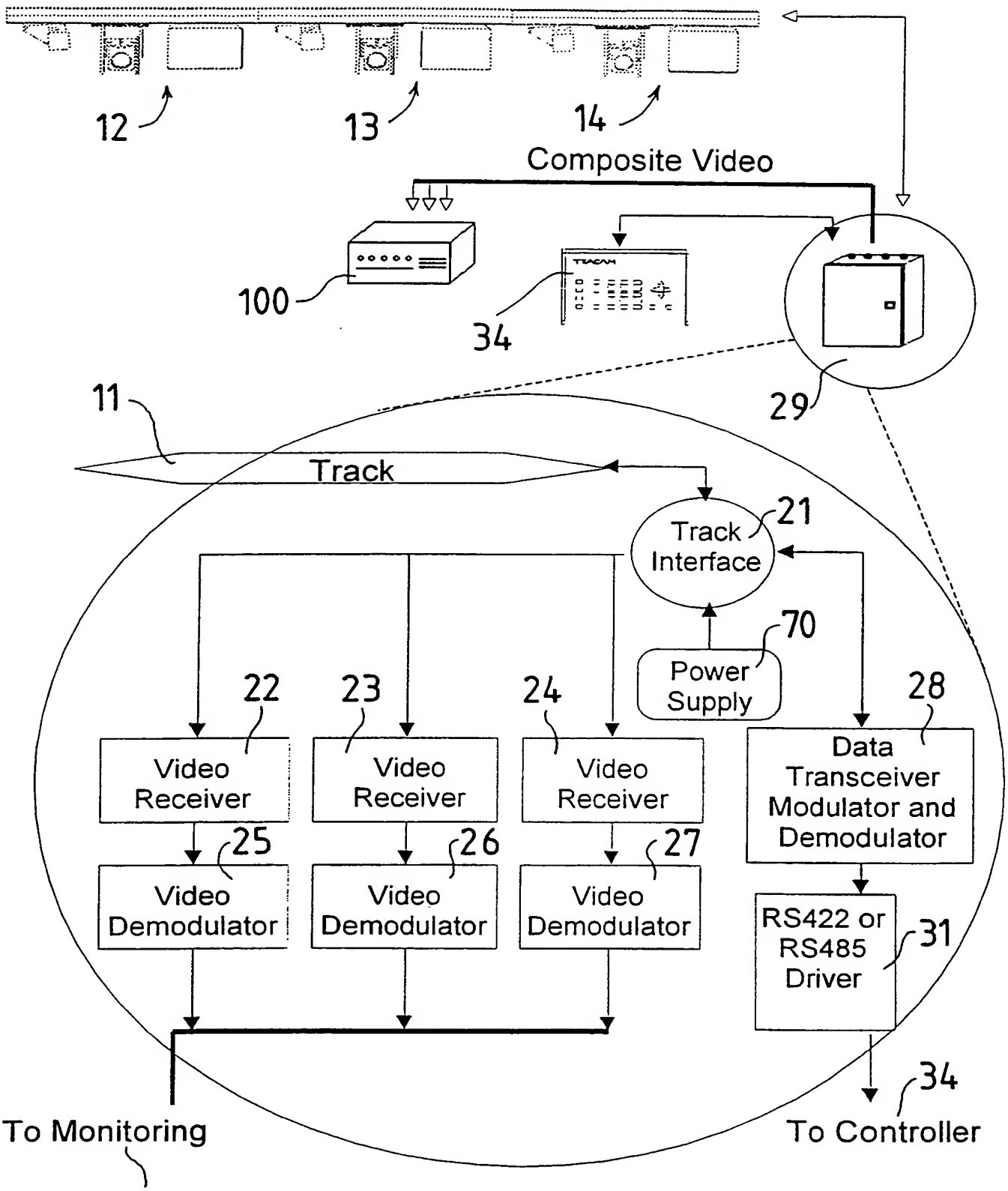
12
13
14
Composite Video
100
34
29
11
Track
Track Interface
21
70
Power Supply
22
23
24
28
Video Receiver
Video Receiver
Video Receiver
Data Transceiver Modulator and Demodulator
25
26
27
Video Demodulator
Video Demodulator
Video Demodulator
RS422 or RS485 Driver
31
34
To Monitoring
100
To Controller

FIG 9

FIG 10/14

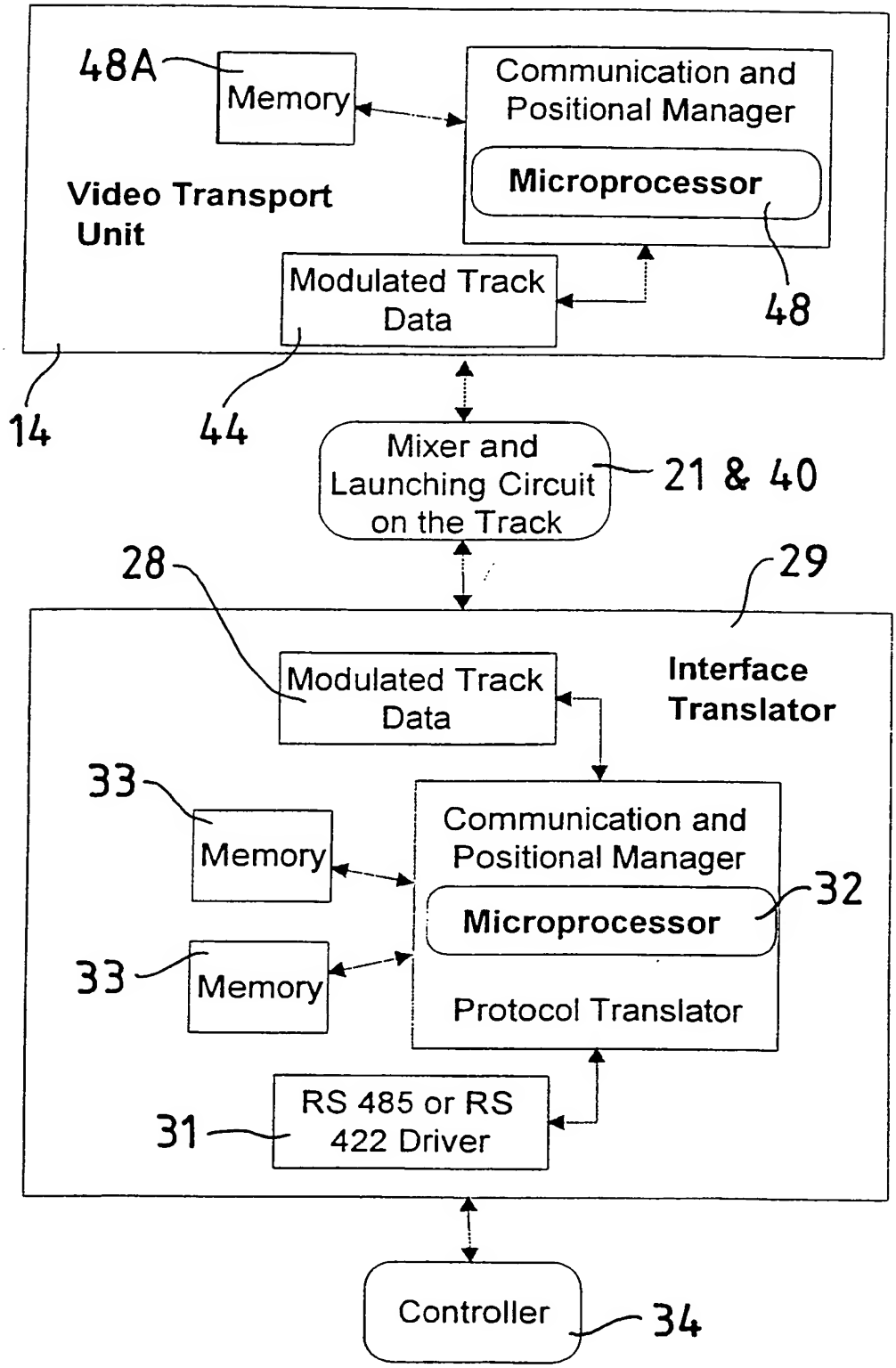

FIG.10

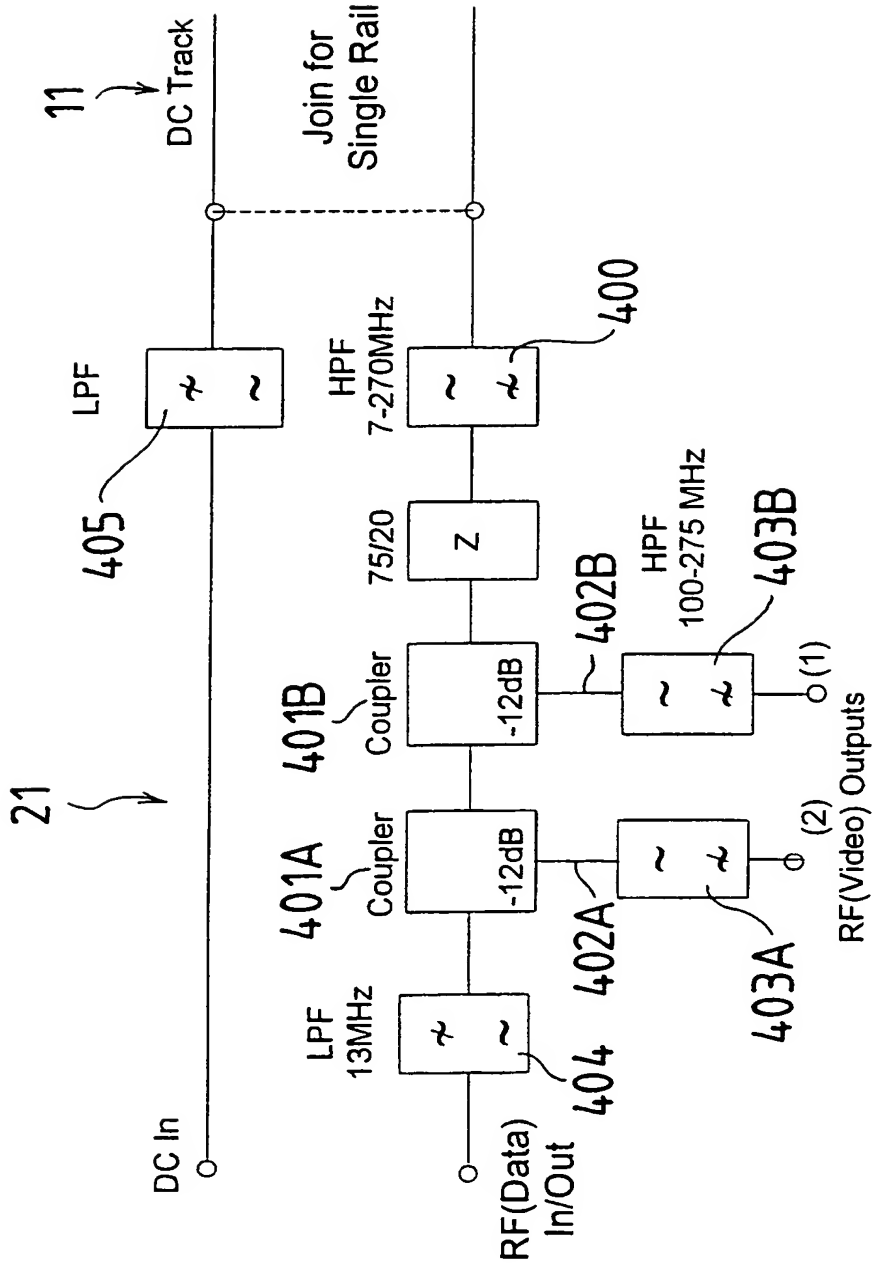
11
DC Track
Join for
Single Rail
LPF
405
HPF
7-270MHz
400
75/20
Z
HPF
100-275 MHz
403B
402B
401B
Coupler
-12dB
(1)
21
401A
Coupler
-12dB
(2)
RF(Video) Outputs
402A
403A
LPF
13MHz
404
DC In
RF(Data)
In/Out

FIG 11

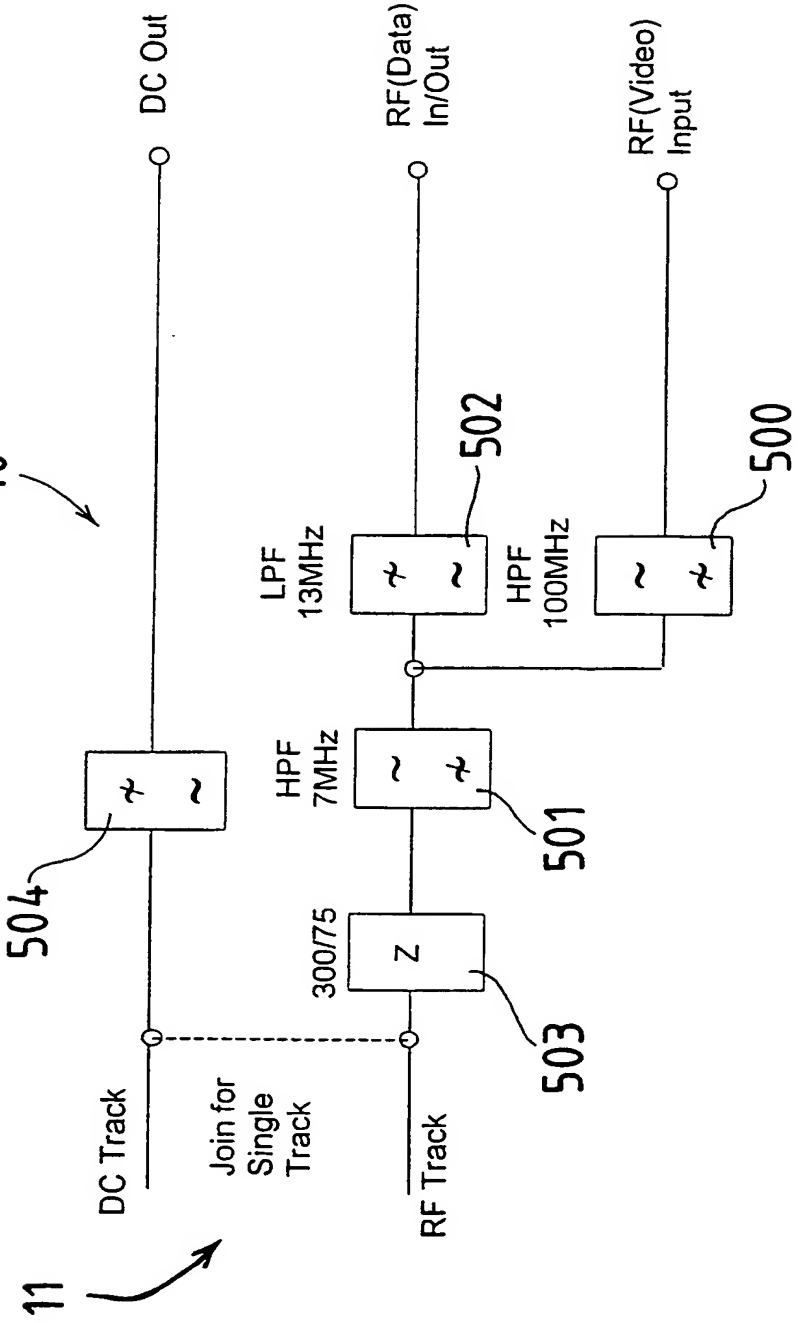
DC Out
RF(Data) In/Out
RF(Video) Input
40
LPF 13MHz
HPF 100MHz
502
500
HPF 7MHz
501
504
300/75
Z
503
DC Track
Join for Single Track
RF Track
11

FIG. 12

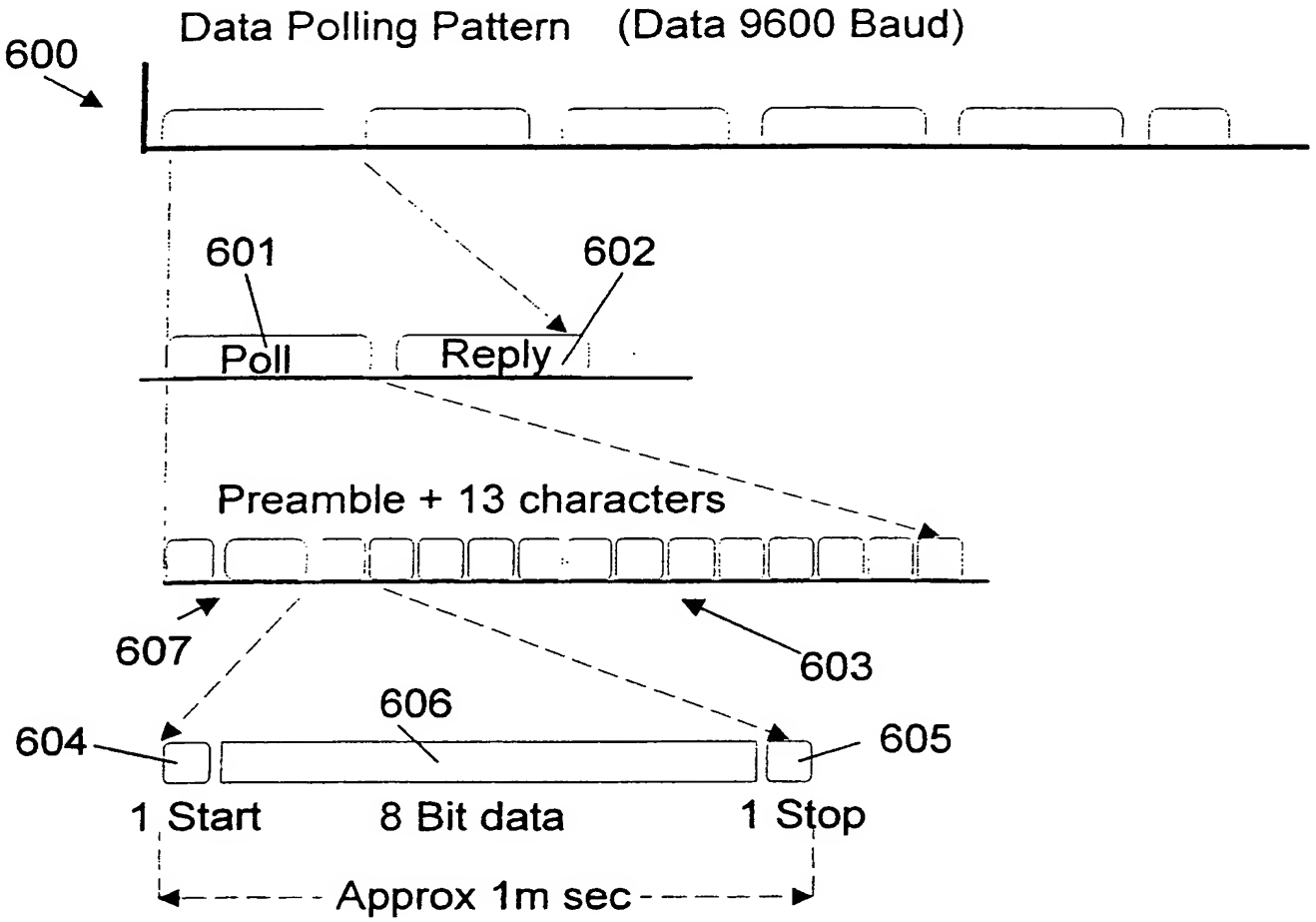
Data Polling Pattern (Data 9600 Baud)
600
601
602
Poll
Reply
Preamble + 13 characters
607
603
606
604
605
1 Start
8 Bit data
1 Stop
Approx 1m sec

FIG. 13

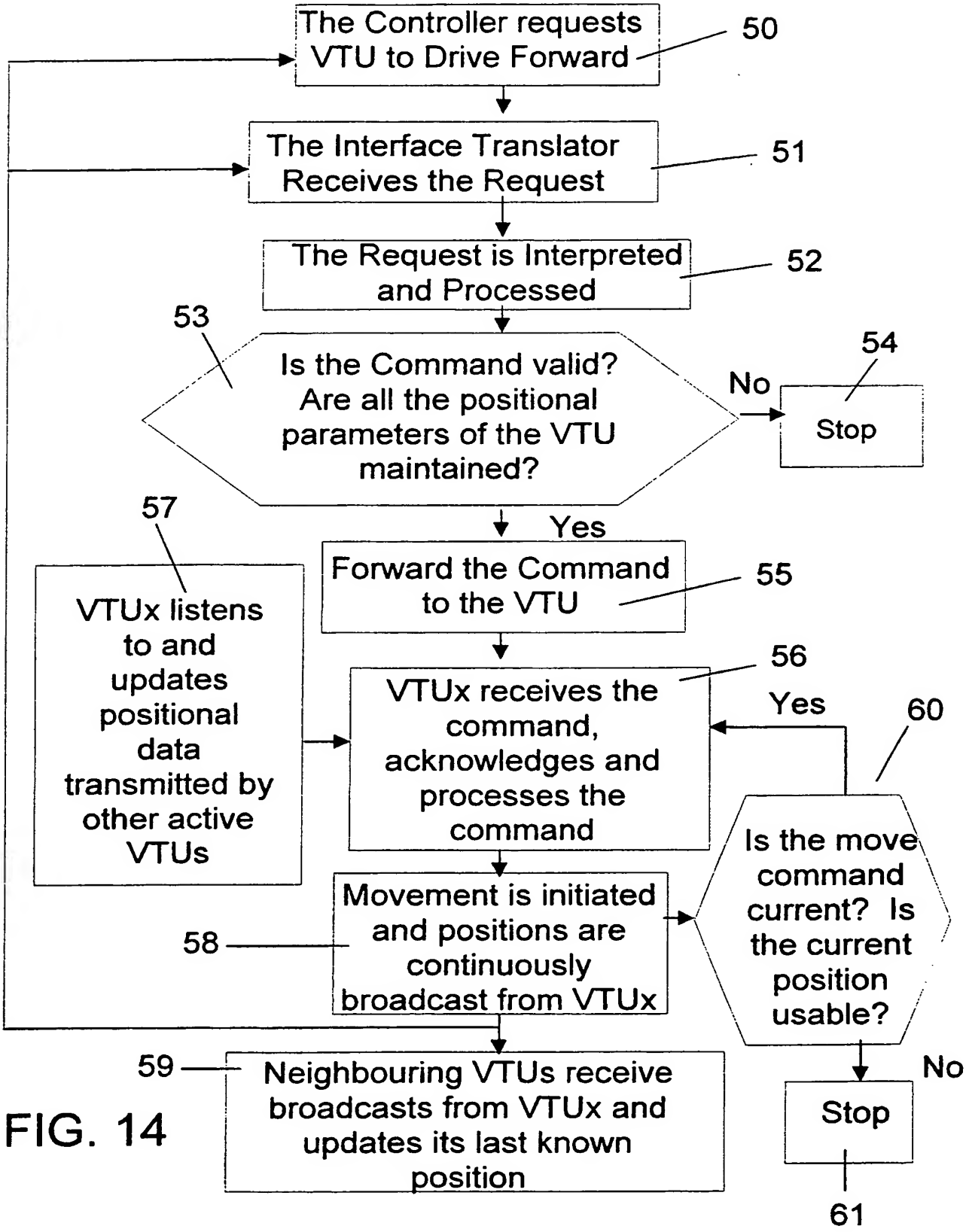
The Controller requests VTU to Drive Forward
50
The Interface Translator Receives the Request
51
The Request is Interpreted and Processed
52
53
Is the Command valid? Are all the positional parameters of the VTU maintained?
No
54
Stop
Yes
57
VTUx listens to and updates positional data transmitted by other active VTUs
Forward the Command to the VTU
55
56
VTUx receives the command, acknowledges and processes the command
Yes
60
Is the move command current? Is the current position usable?
No
Stop
61
Movement is initiated and positions are continuously broadcast from VTUx
58
59
Neighbouring VTUs receive broadcasts from VTUx and updates its last known position

FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00422

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: H04N 7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: Surveillance, monitor, secure, modulation, demodulation, video, audio, camera, view, track, rail, carriage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5241380 A (BENSON et al), 31 August 1993 Whole document	1-38
A	US 5526041 A (GLATT), 11 June 1996 Whole document	1-38
A	FR 2722927 A1 (GIOUSPILLOU PHILIPPE PASCAL-FR) 26 January 1996 Whole document	1-38

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2000	12 JUL 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer MANISH RAJ Telephone No : (02) 6283 2175

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00422

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5018009 A (KOERV), 21 May 1991 Whole document	1-38
A	US 4954886 A (ELBERBAUM) 4 September 1990 Whole document	1-38

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/00422

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5241380	AU	21619/92	CA	2109725	EP	587764
		SG	59994	WO	9222172		
US	5526041	BR	9503950	CA	2149730	EP	701232
		JP	8088847				
US	5018009	EP	384020				
US	4954886	JP	1236873				

END OF ANNEX

ART 34 AMDT

TITLE

"A SURVEILLANCE SYSTEM"

FIELD OF THE INVENTION

The present invention relates to a track mounted multiple mobile camera surveillance system.

BACKGROUND OF THE INVENTION

Remote cameras to survey an area are known and commonly used. Attaching movable surveillance cameras to a track system to permit viewing of different locations is also known and the subject of US Patent Nos. 4,656,509 and 4,510,526. These patents describe remote controlled carriage mounted cameras for surveying an area, but do not permit multiple cameras on a single track.

A typical video surveillance system is disclosed in Australian patent 659190 and comprises a track assembly which is mounted to a room ceiling. A movable carriage is able to travel repetitively back and forth along the track and is provided with a camera to transmit video images of monitored areas to a remote location.

The carriage in AU 659190 comprises two cameras mounted to a single platform, a drive assembly, drive control and video circuit boards. The cameras are mounted to the support platform at different angles in order to observe a wide area.

The track includes two conductors of copper tubing suitably mounted and supported within semi-cylindrical grooves of an isolation block made of electrically insulating material. Each conductor is in slidable contact with at least one corresponding isolated slidable electrically conductive brush located on the underside of the carriage.

Output signals from the cameras are provided to a video modulator board on the carriage which modulates suitable carrier signals for transmission through the conductors to a demodulator connected at

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

15

Applicant's or agent's file reference 1/9140/PC-DKK/NRB	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. **PCT/AU 00/00422**	International filing date *(day/month/year)* 08 May 2000	Priority Date *(day/month/year)* 06 May 1999
International Patent Classification (IPC) or national classification and IPC **Int. Cl.**[7] H04N 7/18		
Applicant 1. LEXTAR TECHNOLOGIES LIMITED		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of **3** sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of **1** sheet(s).

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

Date of submission of the demand 05 December 2000	Date of completion of the report 03 January 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer MANISH RAJ Telephone No. (02) 6283 2175

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 00/00422

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **2-21,** as originally filed,
pages **1,** filed with the demand,
pages , received on with the letter of .

☒ the claims, pages **22-28,** as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages , received on with the letter of .

☒ the drawings, pages **1/14-14/14,** as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of .

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-38	YES
	Claims		NO
Inventive step (IS)	Claims	1-38	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-38	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

1. Claims 1-38 are novel and involve inventive step because no individual citation or obvious combination of citations teach the combination of features claimed in the independent claims.

2. Claims 1-38 have industrial applicability because the invention claimed can be made or used in the industry.

OPI DATE 08/01/93 APPLN. ID 21619/92
AOJP DATE 25/02/93 PCT NUMBER PCT/US92/04639

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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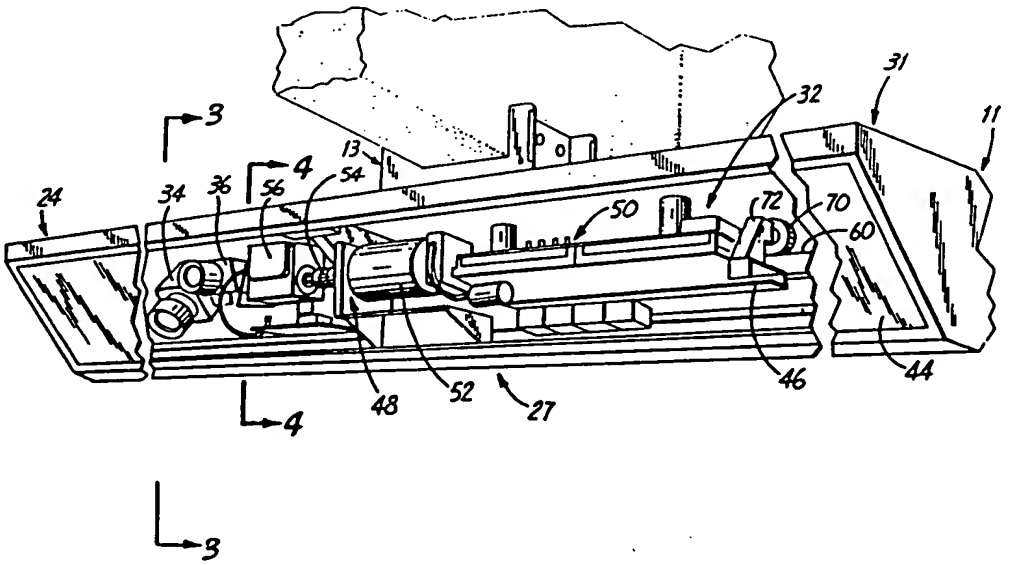
(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), MC (European patent), NL (European patent), SE (European patent).

Published
With international search report.

659190

(54) Title: VIDEO SURVEILLANCE SYSTEM



(57) Abstract

A surveillance system (10) includes a track (90) positioned along a selected path and a moveable carriage (32) supported by the track (90). A pair of electrical conductors (92) mounted adjacent and parallel to the track (90) provide power to a drive assembly (48) mounted on the carriage (32). Video cameras (34, 36) are mounted to the carriage (32) for monitoring selected regions adjacent to the path. Output signals from the cameras are transmitted on the conductors (92) to a remote monitoring location (112). In the preferred embodiment, control signals for controlling placement of the carriage (32) along the track (90) are also transmitted on the conductors.

VIDEO SURVEILLANCE SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a remotely actuated carriage system, and more particularly, to a system having a track mounted, moveable carriage in which power, control and monitored information are transmitted along the same conductors, and which is useful as a surveillance system.

Remote cameras for viewing or monitoring objects are known and widely used in practice. The following patents provide examples of track mounted cameras that are used for a variety of surveillance purposes.

U.S. Patent No. 4,768,090, issued to Camps et al., discloses a surveillance device that includes a tube having a longitudinal window covered by an elastic flap. The elastic flap is lifted up to allow a video camera located in the tube to monitor objects located outside the tube. The video camera is moved within the tube through a vacuum created in the tube, or alternatively, with a stepper motor and drive wheels. Power is supplied to the surveillance device through contacts and rails suitably arranged within the tube, while antennas are provided on the surveillance device and at a remote location for transmitting and receiving signals from the video camera.

U.S. Patent No. 4,656,509, issued to Matsuyama et al., shows a video camera and wireless communication equipment suspended from a rail. The communication equipment controls motion of the video camera on the rail and tilt adjustment of the camera. The communication equipment further receives video signals

from the video camera and transmits the video signals with suitable antennas to a remote operator.

U.S. Patent No. 4,510,526, issued to Coutta et al., discloses a surveillance system supported on a longitudinal track. The system comprises a camera, a wireless transmitter and receiver, motors and a battery secured to a platform that is propelled with friction drive wheels along the track. A power supply or battery charger is connected to bus bars that run lengthwise along the track. Through contacts located on the platform and engaging the bus bars, electrical energy is obtained from the power supply to maintain a sufficient charge on the battery. Control signals are transmitted to and video signals are received from the platform by wireless communication equipment at a remote location.

U.S. Patents No. 4,027,329 and 4,120,004, both issued to Coutta, are similar to the surveillance system mentioned above in that the system comprises a video camera mounted to a suspended track. In these two patents, however, camera motion is provided by a cable and pulley system. It is believed the camera control and video signals are transmitted with wireless communication equipment.

U.S. Patent No. 4,112,818, issued to Garehime, Jr., shows a surveillance and weapon system. The system is suspended from a longitudinal rail. The system includes separate, electrically isolated, contact wipers and bus bars to provide power and control signals to a moveable platform located on the rail. Monitored video and audio information is transmitted to a remote location on separate lines. A spring tensioned takeup reel is provided to dispense and retract the video and audio lines as the platform moves along the rail.

Additional track mounted cameras are disclosed in U.S. Patent No. 4,559,555 issued to Schoolman, U.S. Patent No. 3,482,037 issued to Brown et al., U.S. Patent No. 3,226,476 issued to Tyler, and U.S. Patent No. 2,633,054 issued to Black.

SUMMARY OF THE INVENTION

The present invention provides an improved track mounted remote control actuator system, particularly adapted for surveillance of a large area. The system includes a track positioned along a selected path and a moveable carriage supported by the track. A pair of electrical conductors mounted adjacent and parallel to the track provide power to a drive assembly mounted on the carriage. Video cameras are mounted to the carriage for monitoring selected regions adjacent to the path. Output signals from the cameras are transmitted on the conductors to a remote monitoring location.

In the preferred embodiment, control signals for controlling placement of the carriage along the track are also transmitted on the conductors to the carriage. The control signals comprise a first and second sinusoidal control signal, each control signal having a unique frequency. The first control frequency is used to control the carriage's direction of travel on the track while the second control signal is used to start and stop the carriage. Additional sinusoidal control signals, each having a unique frequency, can be included to vary speed of the carriage on the track or control other surveillance equipment.

A selected number of different control signals could be encoded, sent on a single modulated sinusoidal control frequency, and demodulated on the carriage into

separate control signals. Several control signals thus could be used.

In a further preferred embodiment, the system includes proximity sensors positioned adjacent the track. The proximity sensors provide an output signal when the carriage is positioned adjacent the sensor. When used in the present invention, two proximity sensors are placed at opposite ends of the track to initiate a carriage stop command when the carriage has reached the end of the track. Any number of additional proximity sensors can be periodically positioned at desired locations along the track. When used in conjunction with switches like panic buttons, placed periodically throughout the monitored area, or open door detectors, the sensors signify when the carriage 32 has reached the area of concern.

The system is usable for industrial operations, such as for mounting a traveling hoist that is remotely operated. The video camera could be used as a monitor and the controls would include signals to raise and lower a hoist. Robot arms also could be a part of the carriage and controlled as will be described. Any drive motor for a robot function can be controlled in the same manner as the carriage drive motor described in the following specification.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a track mounted surveillance system of the present invention;

Figure 2 is a perspective view of a portion of the track of Figure 1, particularly illustrating a moveable carriage;

Figure 3 is a sectional view of the track and carriage taken along line 3--3 of Figure 2;

Figure 4 is a sectional view of the track and carriage taken along line 4--4 of Figure 2;

Figure 5 is a schematic diagram of the overall surveillance system;

Figure 6 is a schematic diagram of a control signal generating circuit; and

Figure 7 is a schematic diagram of a control signal decoding circuit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, Figure 1 illustrates an embodiment of the present invention installed as a surveillance system 10. Surveillance system 10 is mounted to a ceiling 12 with a plurality of mounting brackets 13. In this embodiment, surveillance system 10 is mounted along an outside edge 14 of a particular floor 16 of a parking garage 17. Surveillance system 10 is used to observe the overall monitored area of parking floor 16 including parking spaces 18, entrance/exit doors 20, and other adjoining walls and motor vehicle entrance/exit locations, not shown.

In the preferred embodiment, surveillance system 10 is constructed from a plurality of individual sections such as 24, 25, 26, 27, 28, 29, 30 and 31 to form a connected track assembly 11 of any given length. A movable carriage 32, shown in Figure 2, travels repetitively back and forth within track assembly 11 to provide video images of the monitored area to remote monitors 38.

Figure 2 illustrates carriage 32 within track section 27. Portions of end sections 24 and 31 are provided to emphasize that carriage 32 moves along the complete length of the connected track assembly 11. A

semi-opaque front cover 44 has been removed from track section 27 in order to illustrate in detail the components of carriage 32. Cover 44 essentially enables one-way viewing in that cameras 34 and 36 mounted upon carriage 32 can look outward through cover 44, but people located within the monitored area would be unable to see carriage 32, thus preventing them from determining the carriage's position within the connected track assembly 11. Cover 44 is mounted within opposed upper and lower U-shaped channels 45 shown in Figure 3.

Carriage 32 comprises a support platform 46, cameras 34 and 36, a drive assembly 48 and drive control and video circuit boards, generally shown as 50, mounted thereupon. Cameras 34 and 36 are mounted to platform 46 at different angles in order to observe completely the monitored area. As shown in Figure 3, camera 34 is directed downward to observe those areas below track assembly 11 while camera 36 is directed outward to observe those areas substantially away from track assembly 11. Either or both of the cameras 34 and 36 can be equipped with a zoom type lens that would be remotely controlled by a remote counsel 112 (Figure 5). The foregoing camera arrangement allows cameras 34 and 36 to view selected portions of the monitored area in an overlapping, panoramic view or in separate detailed close up views. Although cameras 34 and 36 are shown in Figures 2 - 4 at fixed positions, suitable known, controllable tilt mechanisms can be provided to selectively adjust each respective camera tilt angle, using motors controlled through signals in the same manner as will be described for controlling movement of the carriage 32.

Carriage 32 is driven longitudinally along the connected track assembly 11 with drive assembly 48. Drive assembly 48 comprises an electric motor 52, shown in Figure 2, having an output shaft 54 connected to a transmission 56 which in turn rotates a drive wheel 58 shown in Figure 4. Drive wheel 58 is positioned above a suitable drive plate 60 mounted longitudinally along a back wall 62 of each track section 24-31. The circumference of drive wheel 58 provides a rubber drive surface to improve friction with drive plate 60.

Drive wheel 58 together with an upper guide wheel 68, both shown in Figure 4, and a front guide wheel 70, shown in Figure 2, support the downward force of carriage 32. Front guide wheel 70 is supported on drive plate 60 and is connected to a suitable bracket 72 mounted to support platform 46. Upper guide wheel 68 is positioned on a L-shaped guide ledge 76 that extends longitudinally along the connected track assembly 11. Upper guide wheel 68 connects to an upward extending brace 78 that is fixed to support platform 46.

Two separate horizontal guide wheel assemblies 80, one at each end of support platform 46, provide lateral or horizontal support for carriage 32 in track assembly 11. The wheel assemblies 80 are identical and, as shown in Figure 4, comprise two guide wheels 81 positioned on opposite sides of a guide plate 82 that extends longitudinally along the connected track sections. In the preferred embodiment, guide plate 82 is integrally formed with and extends down from drive plate 60. Guide wheels 81 are connected to support platform 46 through a suitable support brace 84 and are rotatably mounted on shafts 83 mounted on brace 84.

Referring to Figure 4, power and control signals are provided to carriage 32 and monitored surveillance information is received from carriage 32 along a signal rail 90. Rail 90 extends longitudinally along the connected track sections on back wall 62 and comprises a pair of spaced apart, electrically isolated conductors 92. In the preferred embodiment, conductors 92 comprise cylindrical, copper tubing suitably mounted and supported within semi-cylindrical grooves 94 of an isolation block 96 made of electrically insulating material. Each conductor 92 is in slidable contact with at least one corresponding isolated slidable electrically conductive brush 96 (shown schematically as brushes 96A, 96B, and 96C in Figure 5) along the length of rail 90. Each brush 96 is biased against the respective conductor 92 by a spring 98 that is inserted within a support 100 also made of electrically insulating material. Brushes 96 are mounted to support platform 46 with a suitable bracket 101.

The overall surveillance system 10 is illustrated in the schematic diagram of Figure 5. Besides carriage 32 and rail 90, the system includes a remote monitoring and control station 112, a control interface 113, and a power source 110. Control station 112 allows an operator to monitor the video images from cameras 34 and 36 and is located in a convenient location, such as a building control office. The output signals from cameras 34 and 36 are each provided to a video modulator board 114 on carriage 32 where suitable carrier signals are frequency modulated by each respective camera output signal in a known manner. The output signal from video modulator board 114 is applied to brushes 96C that slidably engage conductors 92.

Conductors 92 are connected to a video adaptor 117 comprising a transformer for isolation and impedance matching to insure getting a good video signal capable of transmission. An output signal from video adaptor 117 is provided to a demodulator 119 by suitable transmission wires such as a coaxial cable since both video adapter 117 and demodulator 119 are fixed installations. Demodulator 119 demodulates each camera output signal from its respective carrier signal and displays the corresponding image on monitors 38, again using known techniques.

Remote station 112 includes a control console 120 which would be used by the operator to control placement of carriage 32 to obtain the desired surveillance. Counsel 120 contains conventional circuitry to apply, by means of any convenient control devices 122, the desired operator command signals to control interface 113. Such operator command signals include switches for direction and adjustable controls for establishing rate of travel of carriage 32 along the connected track sections or, if desired, an automatic mode operation wherein the carriage travels back and forth along the connected track sections without operator intervention. If further desired, additional control devices can be added to manage, for example, tilt angles and zoom capabilities of the cameras, or other types of monitoring equipment.

Control interface 113 is connected to a system processor 124. System processor 124, comprising a conventional micro-processor, receives the desired command signals from counsel 120 and input signals through control interface 113 from proximity sensors 126, 128 and 130 that are positioned along the connected

track sections. From both the command signals and activation of the proximity sensors when the carriage 32 is positioned adjacent a respective proximity sensor, the system processor 124 determines which control signals are transmitted along conductors 92 to carriage 32.

Sensors 126 and 128, positioned at opposite ends of the connector track sections, signify that the carriage 32 has reached the respective end of track assembly 11. If carriage 32 is under manual operation by the operator at the remote monitoring station 112, activation of an end sensor 126 or 128 would initiate a carriage stop command from the system processor 124 thereby stopping carriage 32 and preventing further movement in the same direction beyond the end of the track assembly 11. Alternatively, if the system is under automatic control, activation of end sensor 126 or 128 would cause carriage 32 to stop and subsequently begin travel in the opposite direction, again from an appropriate command provided by the system processor 124. Any number of additional proximity sensors 130 can be periodically positioned at desired locations along the connected track sections. When used in conjunction with switches 132, such as panic buttons, placed periodically throughout the monitored area, or open door detectors, the sensors 130 signals the system processor 124 to indicate when the carriage 32 is adjacent the area of concern.

As with the video images described above, the control signals for carriage 32 are transmitted on conductors 92. In the preferred embodiment, the control signals comprise separate sinusoidal signals each having a unique frequency transmitted for an appropriate time

duration. The circuit for generating such signals are shown in Figure 6. In the present invention, two separate sinusoidal control signals at two unique frequencies are used. The first control signal frequency signifies direction of carriage travel whereby transmission of the first control signal causes the carriage to travel in a first direction along the track while absence of the first control signal causes the carriage to travel in the reverse direction.

The second control signal signifies speed of travel. When the second control signal is transmitted, the carriage moves along the track in the previously selected direction. When transmission of the second control signal is discontinued, the carriage stops. An additional third control signal at a third unique frequency can be added to vary the speed of the carriage. In this embodiment, transmission of the third control signal, without transmission of the second control signal, increases the speed of the carriage. If both the second and third control signals are transmitted the carriage travels at its fastest rate.

The information contained on any one or all of the sinusoidal control signals could be increased by a variety of modulation techniques such as, but not limited to, pulse width, pulse position, or pulse code modulation. The circuit would then include a modulator at the control station and a demodulator on the carriage for providing discrete control signals for the motor and other operated components on the carriage.

A motor control adaptor 136 mounted to carriage 32 detects the presence of any control signals on conductors 92 through brushes 96A. Motor control adaptor 136 as will be shown in detail in Figure 7

provides appropriate command signals of direction and speed to the drive assembly 48 based on the detected control signals. If desired, additional control signals at additional unique frequencies can be provided to control camera operation and other forms of monitoring equipment mounted to the carriage 32.

Power source 110 is connected to each conductors 92 of rail 90 to provide all necessary power to carriage 32. In the preferred embodiment using a conventional 115 AC voltage source 116, the voltage is reduced through a step-down transformer 118, the output of which being rectified and conditioned to suitable DC voltage (for example 30 volts) through convertor 120. Alternatively, AC voltage can be applied to rail 90 with DC conversion performed on carriage 32. Required power to operate drive assembly 48, specifically motor 52, is carried through brushes 96B to the motor.

A control driver circuit 140 for generating each of the frequency controlled control signals based on commands from the system processor is illustrated in Figure 6. Control driver circuit 140 comprises three signal generating circuits 142, 144, and 146 each generating a control signal at a unique frequency based on initiation of the generating circuits at inputs 148, 150 and 152, respectively. Inasmuch as each signal generating circuit 142, 144 and 146 is identical, with differences only in circuit components to generate a unique control frequency, different from the frequencies of the other signal generating circuits, description will be confined to signal generating circuit 142. Signal generating circuits 144 and 146 operate in the same manner.

Signal generating circuit 142 comprises an input isolation circuit 154, an adjustable square wave oscillator 156 and a low pass output filter 158. Input 148 is connected to current limit resistor 160 that is in turn series connected to photo-coupled isolation transistor 162. Collector 163 of transistor 162 is connected to a transistor circuit 164. An appropriate filter capacitor 165 and bias resistors 166, 168 and 170, selected on the basis of the supply voltage, are provided to operate transistor 172 as an invertor. The collector of transistor 172 provides an input signal to oscillator 156 at input 174.

Oscillator 156 generates a square wave control signal at a unique frequency. In the preferred embodiment, oscillator 156 comprises an LM567 Tone Decoder, manufactured by National Semiconductor. The output frequency (f_o) at output 175 of oscillator 156 is approximated by $f_o \approx \frac{1}{1.1\,R_1 C_1}$ where (R_1) is resistor 176 and (C_1) is capacitor 178. Capacitor (C_2) 180 is used for bandwidth adjustment. In the preferred embodiment, the output frequency of signal generating circuits 142, 144 and 146 are adjusted within the range 20 - 40 KHz. Further reference is herein made to National Semiconductor Linear Databook (1982) for specific operating characteristics of the LM567 Tone Decoder. A crystal oscillator can be used as an alternative embodiment to the Tone Decoder previously described. Crystal controlled oscillators for providing a square wave signal at selected frequencies are known.

Initiation and generation of the control signal from signal generating circuit 142 is as follows. With an appropriate voltage applied to input 148

initiated from system processor 124, transistor 162 is turned on, lowering the voltage at collector 163 and turning off transistor 172. With transistor 172 turned off, oscillator 156 is initiated, producing the control signal with the unique frequency at output 175. The output control signal at 175 is applied to low pass filter 158 which removes the harmonic frequencies that are the above frequency selected for oscillator 156. Low pass filter 158 provides an output signal that is substantially sinusoidal at the frequency of oscillator 156. The output of low pass filter 158 is in turn connected to an amplifier 182 the output of which is connected to one of the conductors 92. The control signal is transmitted to the carriage 32 on conductor 92 for an appropriate time duration sufficient such that the signal is recognized as a legitimate control signal using tone detector circuits shown in Figure 7. After the selected time, the input voltage at input 148 is removed, turning off oscillator 156.

Each of the control signals generated by control driver circuit are detected separately upon transmission on conductors 92 by a receiver and frequency detector circuit 190 shown in Figure 7 of motor control adaptor 136. Receiver circuit 190 comprises an amplifier 192 connected in series with a high pass filter 194 and a low pass filter 196. In the preferred embodiment, high pass filter 194 substantially removes all signals with frequencies less than 15 KHz, while low pass filter 196 substantially removes all signals with frequencies greater than 45 Khz.

The output signal from low pass filter 196 on a signal line 197 is provided in parallel to three tone detector circuits 198, 200 and 202. As with the signal

generating circuits 142, 144 and 146 of the control driver circuit 140 described above, each of the tone detector circuits 198, 200 and 202 is identical with differences only in circuit components such that each tone detector circuit responds to a specific control frequency, matched to one of the unique frequency outputs of signal generating circuits 142, 144 and 146. A terminator 203 can be provided between conductors 92 to minimize signal reflections which can interfere with the R.F. signals from the video carrier (see Figure 5). The use and selection of termination values to reduce signal reflections are known.

In the preferred embodiment, tone detector circuits 198, 200 and 202 of motor control adapter 136 each include an LM567 tone decoder 204, 206, and 208 described above. Each tone decoder 204, 206 and 208 provides a saturated transistor switch to ground output signal at outputs 210, 212 and 214, respectively, when an input signal having the selected frequency is detected at the respective inputs 216, 218 and 220. The selected response frequency of each tone decoder is adjusted with R_1 and C_1 according to the equation given above while the bandwidth is adjusted by C_2. The output signals from tone detectors 198, 200 and 202 are provided to isolation means 222, 224 and 226 respectively. The isolation means 222, 224 and 226 are devices capable of providing an output signal that is electrically isolated from its input signal. In one preferred embodiment, a 4N35 photo coupled isolation transistor is used as the isolation means 222, 224 and 226.

The output signal from isolation means 222 is provided to switch means 228, drive means 230 and

invertor 232. The invertor 232 represents a device capable of providing an output signal that is the compliment of the input signal. The output signal of invertor 232 is provided to switch means 234 and drive means 236. The outputs of isolation means 224 and 226 are provided to pulse width modulator 238. The pulse width modulator 238 provides an output signal having any one of a number of predetermined duty cycles that can be selected by the pulse width modulator 238 inputs. The pulse width modulator 238 output signal is provided to the inputs of drive means 230 and 236.

Drive means 230 and 236 represent any such device capable of providing an output signal that is suitable to control switch means 238 and 240. In one preferred embodiment, drive means 230 and 236 are bipolar transistors such as 2N2907's. Drive means 230 and 236 have an enable input represented by the base portion of the bipolar transistor and a signal input represented by the collector portion of the bipolar transistor. The output of drive means 230 and 236 is represented by the emitter portion of the bipolar transistor. The output signal from drive means 230 and 236 are provided to the inputs of switch means 237 and 240, respectively.

Switch means 228, 234, 237 and 240 are any such devices capable of high current switching such as field effect transistors (FET). In one preferred embodiment, switch means 228, 234, 237 and 240 are Power FET's of the type IRFZ 40. Switch means 228, 234, 237 and 240 are connected together to form an "H switch" with switch means 234 and 228 forming the upper half of the "H" and switch means 237 and 240 forming the lower half of the "H." The upper and lower portions of the

"H" are connected to the positive and negative terminals of supply voltage V_R, respectively. Motor 52 is connected between the upright portions of the "H" i.e., between the source terminals of the FETS represented in switch means 234 and 237.

Diode bridge 242 is connected between power supply V_R with the common cathode junction connected to $+V_R$ and the common anode portion connected to $-V_R$.

In operation, an output signal 210 from tone detector 198 above a certain magnitude closes switch means 228 thereby providing a low resistance path between one input to motor 52 and the positive rail voltage $+V_R$. Nearly simultaneous with the closing of switch means 228, switch means 237 becomes conducting for a selected duty cycle determined by the pulse width modulator 238. Switch means 234 is out of phase from switch means 228 and therefore is open. The motor 52 has an effective EMF determined by the duty cycle of the pulse width modulator 238. Bridge 242 provides an alternate path for motor current when the switches are open, thereby preventing voltage spikes from the windings of motor 52 from damaging the switch circuits.

When output signal 210 from tone detector 198 is pulled to ground, switch means 234 is closed and switch means 228 is open. The voltage across motor 52 is now reversed from the previous case when the tone detector output signal 210 was above a threshold level. Switch means 240 is conducting for a duty cycle determined by pulse width modulator 238. In this manner, the direction of the motor rotation and thus the carriage 32 direction can be controlled.

Pulse width modulator 238 may be selected such that the output signal 212 from tone detector 200 acts

as an enable signal for the pulse width modulator 238. The output signal 214 of tone detector 202 can then be used to select one of two predetermined duty cycles from pulse width modulator 238. Representing a slow and a fast speed for the carriage 32. Additional control frequency tone detectors with corresponding control frequency signal generators can be added to the surveillance system to control additional monitoring functions such as zoom capabilities and tilt angles of the cameras.

In summary, the present invention provides a track mounted, remotely controlled system well suited for many installations. The system is flexible both in installation and operation, yet remains unobtrusive. With transmission of power, control and as disclosed monitor signals on a single pair of conductors, the system has eliminated wireless communication equipment, simplifying the overall design, and thus, reducing manufacturing costs. For many industrial applications the carriage could mount hoists, robot arms, or other work elements that may be remotely controlled using the same signal transmission for control as described. Video also can be used for monitoring operations.

Improved motor control performance can be achieved by incorporating conventional motor back EMF speed sensor 291 and motor current sensor 292 to provide signals as additional inputs to pulse width modulator 238. Examples of improved motor performance could include more accurate carriage speed control, and smoothly controlled acceleration and deceleration.

The track and system can be mounted on ceilings or other structural components. The track also can be mounted so the carriage runs vertically. The

drive rollers can be modified to be pinch rollers running on a flange or vertical track-like cable for vertical travel.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A surveillance security system comprising:

a carriage track positioned along a path, the carriage track having a first end and second end;

a pair of electrical conductors mounted along the path parallel to the track from the first end to the second end;

a carriage adapted to be supported by and moveable on the track;

drive means mounted on the carriage for positioning the carriage along the track, the drive means contacting the pair of electrical conductors to receive a power signal, the power signal providing sufficient electrical power to move the carriage;

camera means mounted on the carriage to monitor regions along and adjacent the path and provide an output signal representative of the monitored regions;

modulation means connected to the camera means receiving the output signal and modulating a carrier signal with the output signal, the modulation means contacting the pair of electrical conductors to transmit the modulated carrier signal on the pair of electrical conductors to a remote monitoring station connected to the pair of electrical conductors; and

termination means connected to the pair of electrical conductors remote from the modulation mean for minimizing reflections of signals transmitted on the pair of electrical conductors.

2. A system as claimed in claim 1 and further comprising control means connected to the pair of electrical conductors, the control means generating a first control signal for controlling operation of the drive means, the first control signal transmitted to the drive means on at least a portion of the pair of electrical conductors and having a frequency different than the power signal.

3. A system as claimed in claim 2 wherein the first control signal selectively controls direction of carriage motion; and the control means further generates a second control signal transmitted to the drive means on at least a portion of the pair of electrical conductors, the second control signal selectively controlling the speed of carriage travel.

4. A system as claimed in claim 3 wherein the first control signal comprises a first frequency and the second control signal comprises a second frequency.

5. A system as claimed in claim 3 wherein the electrical power provided to the drive means is pulse width modulated to selectively control the speed of carriage travel.

6. A system as claimed in claim 1 and a proximity sensor positioned adjacent the track, the proximity sensor providing an output signal when the carriage is positioned adjacent the sensor.

7. A system as claimed in claim 6 wherein the proximity sensor is positioned at the end of the track, and a second proximity sensor is positioned at the opposite end of the track.

8. A system as claimed in claim 1 and display means located at the remote location and electrically connected to the pair of conductors, the display means receiving the electrical output signal and displaying a representative video output.

9. A surveillance security system comprising:

a carriage track positioned along a path, the carriage track having a first end and second end;

a pair of electrical conductors mounted along the path parallel to the track from the first end to the second end;

a carriage adapted to be supported by and moveable on the track;

drive means mounted on the carriage for positioning the carriage along the track, the drive means contacting the pair of electrical conductors to receive a power signal, the power signal providing sufficient electrical power to move the carriage;

a remote receiving station connected to the pair of electrical conductors;

surveillance means mounted on the carriage to monitor regions along the path and provide an output signal representative of the monitored regions;

modulation means connected to the surveillance means receiving the output signal and modulating a carrier signal with the output signal, the modulation means contacting the pair of electrical conductors to transmit the modulated carrier signal on the pair of electrical conductors to a remote monitoring station; and

termination means remote from the modulation means connected to the pair of electrical conductors for minimizing reflections of signals transmitted on the pair of electrical conductors.

10. A system as claimed in claim 9 wherein said surveillance means comprises a camera for monitoring regions along and adjacent the path, the camera providing an output signal representative of the monitored regions.

11. A system as claimed in claim 9 and control means connected to the pair of electrical conductors, the control means generating a first control signal for controlling operation of the drive means, the first control signal transmitted to the drive means on at least a position of the pair of electrical conductors and having a frequency different than the power signal.

12. A system as claimed in claim 11 wherein the first control signal selectively controls direction of the carriage; and the control means further generates a second control signal transmitted to the drive means on at least a portion of the pair of electrical conductors, the second control signal selectively controlling a further function of the carriage.

13. A system as claimed in claim 12 wherein the first control signal comprises a first frequency and the second control signal comprises a second frequency.

14. A system as claimed in claim 1 or 9 substantially as herein described with reference to the accompanying drawings.

DATED this 28th day of February, 1995.

VIDEO SENTRY CORPORATION

WATERMARK PATENT & TRADEMARK ATTORNEYS
290 BURWOOD ROAD
HAWTHORN VICTORIA 3122
AUSTRALIA

(DOC 02 AU2161992.WPC RCTS/SMM:KP)

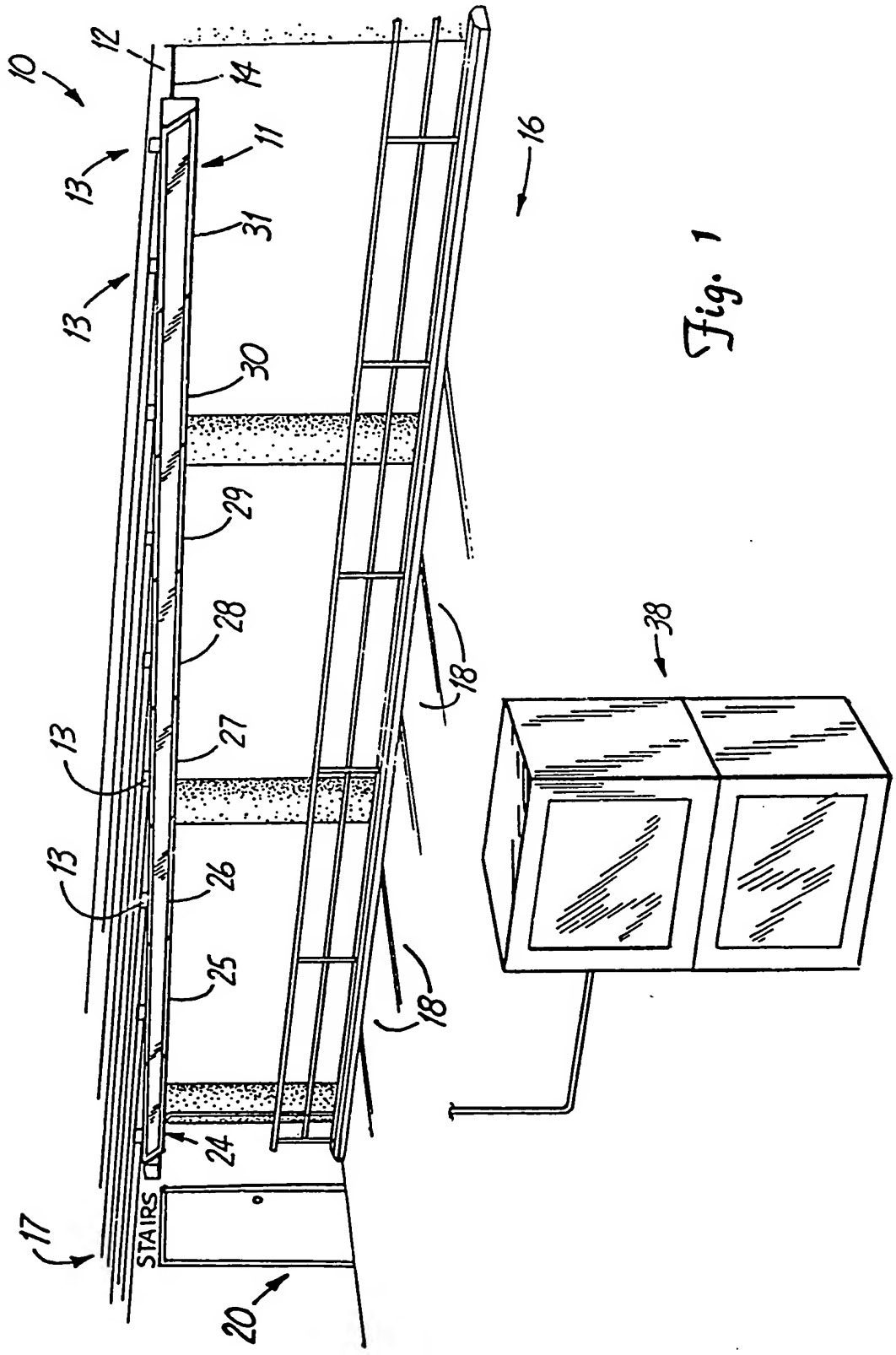

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Fig. 1

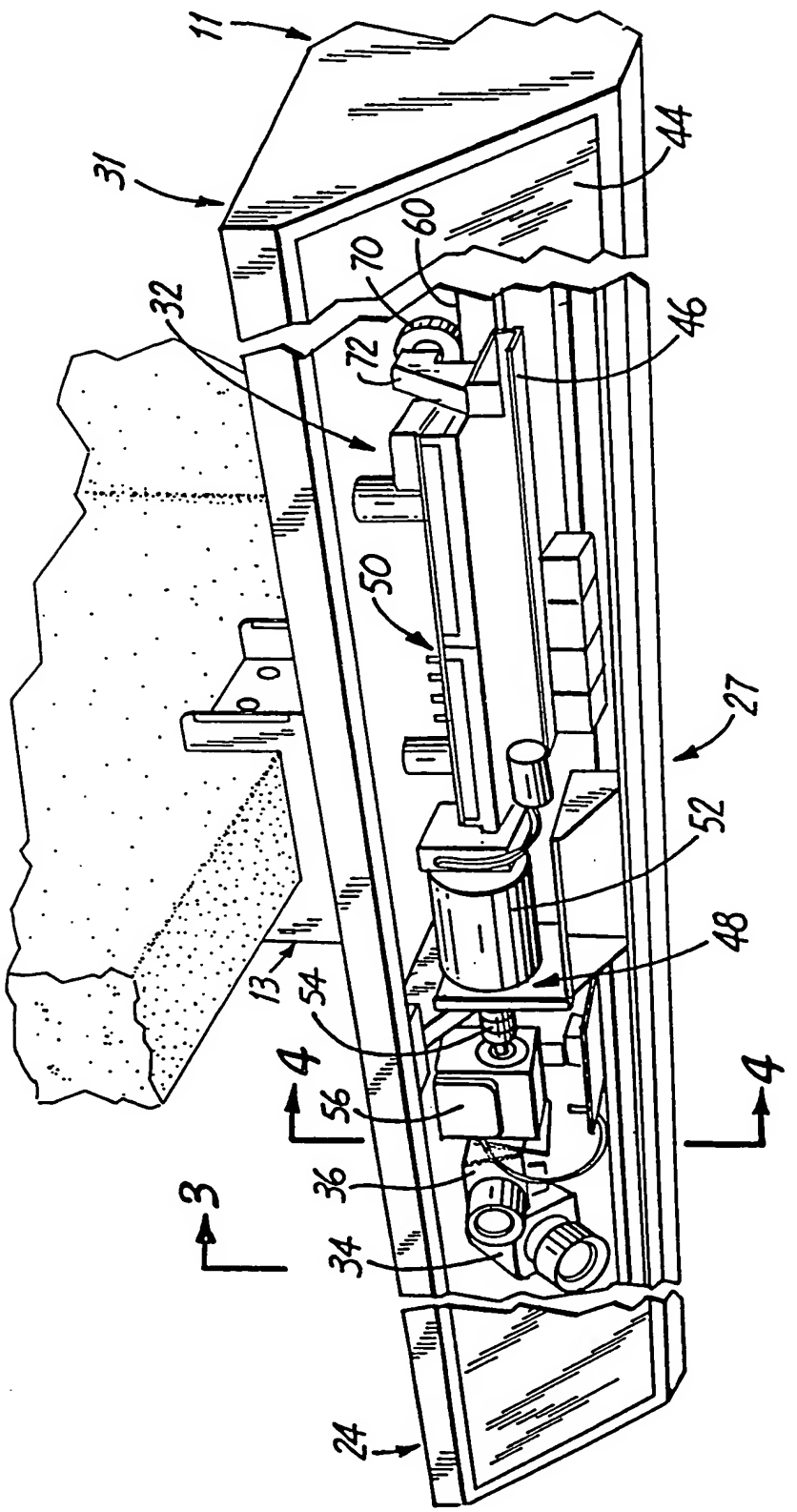

Fig. 2

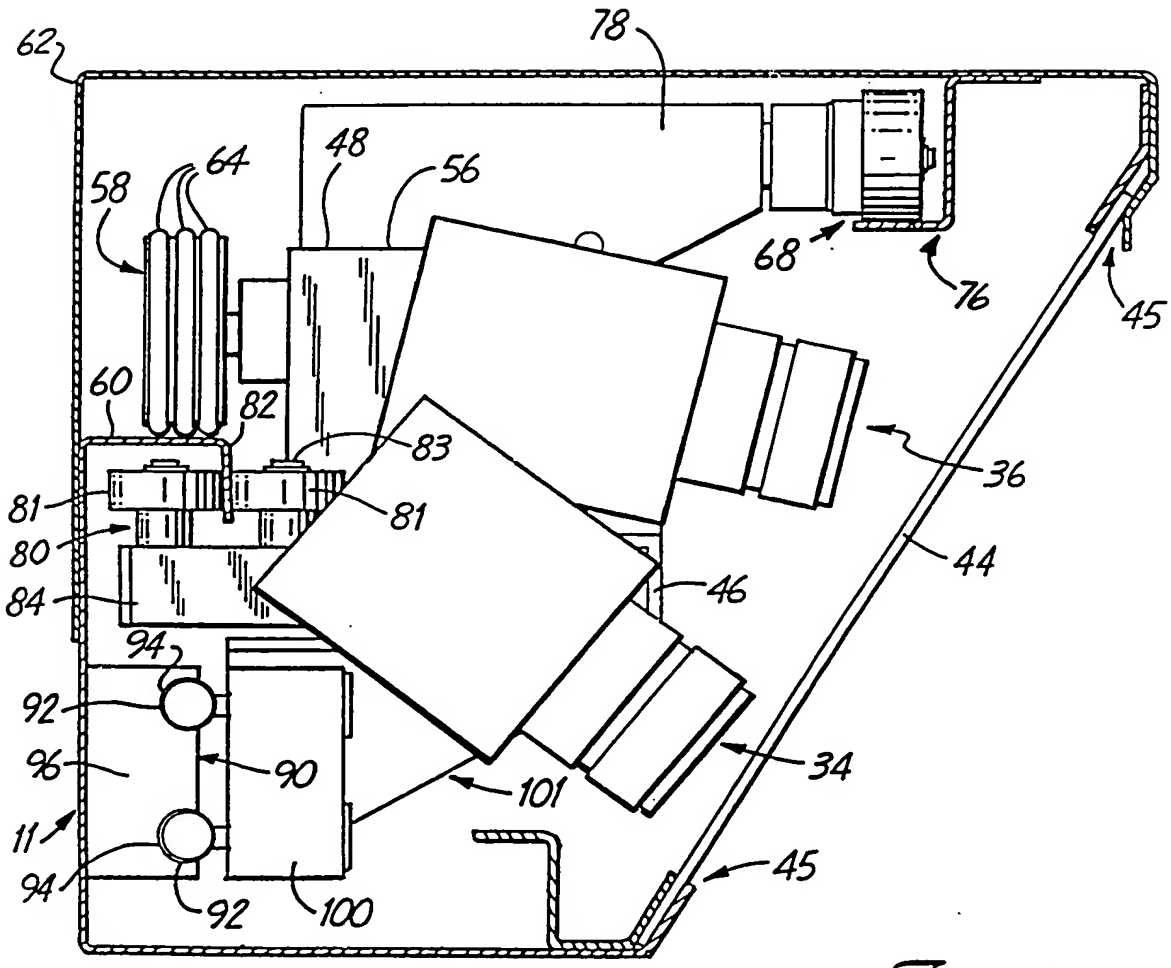
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Fig. 3

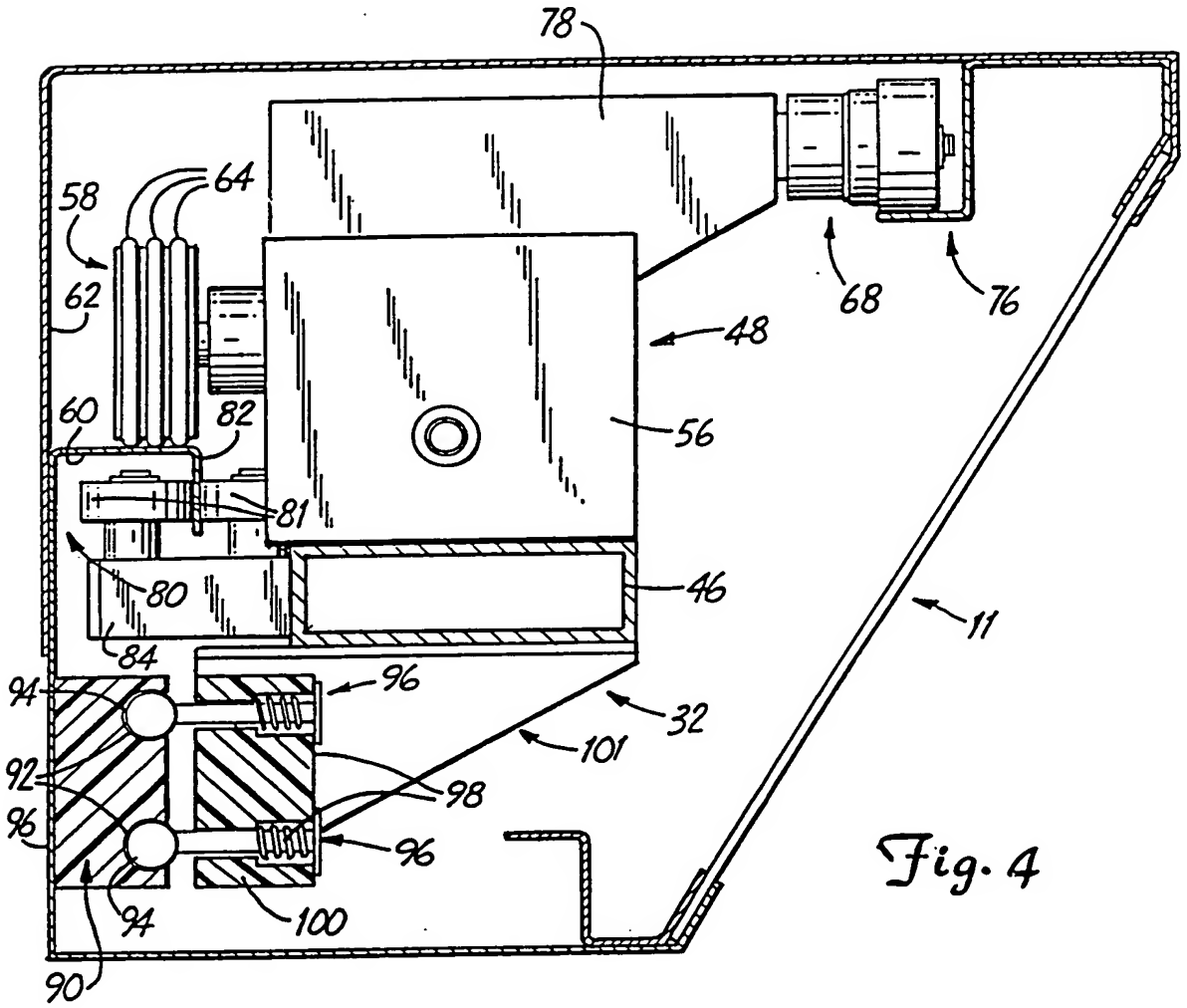
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Fig. 4

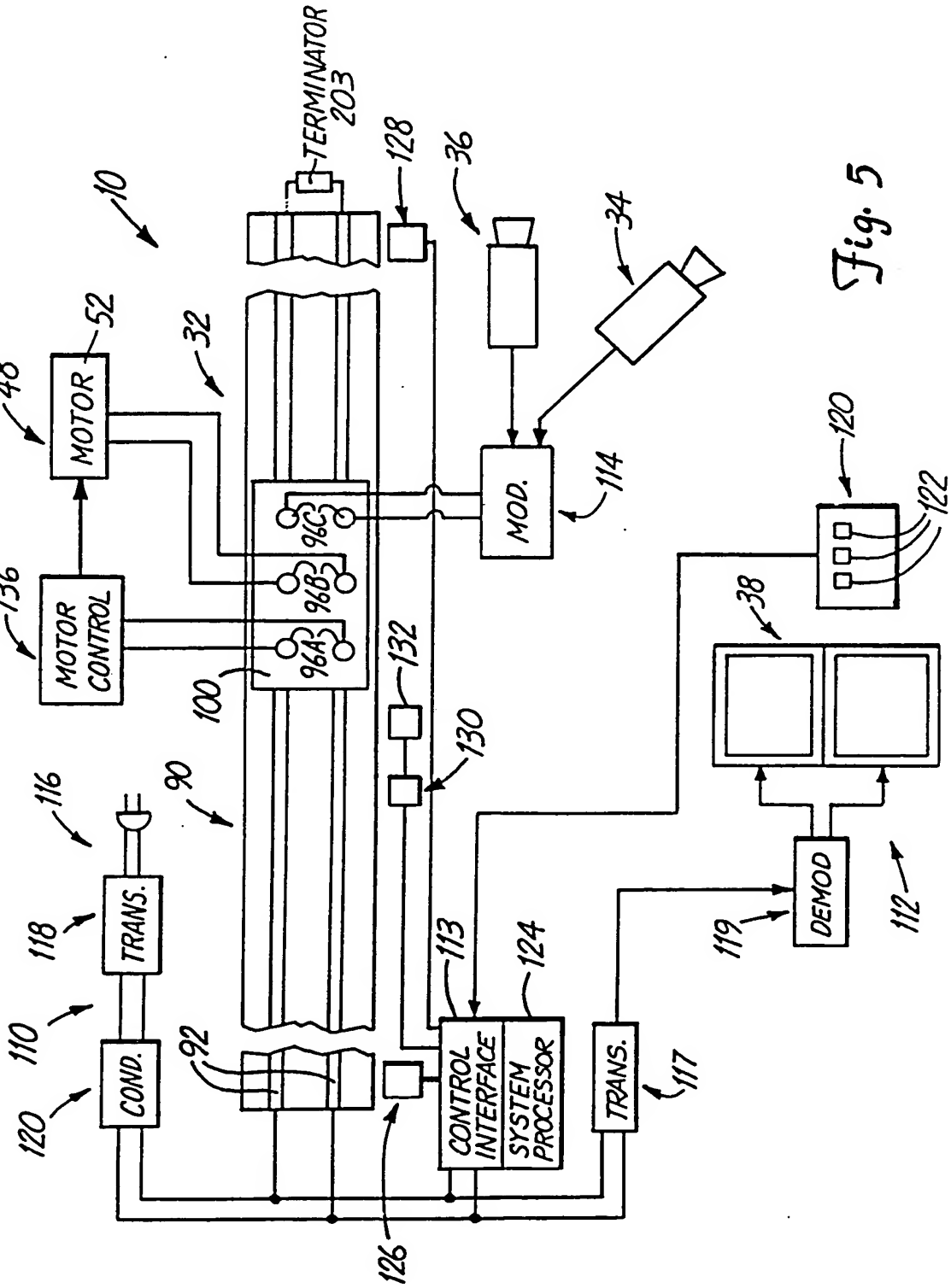
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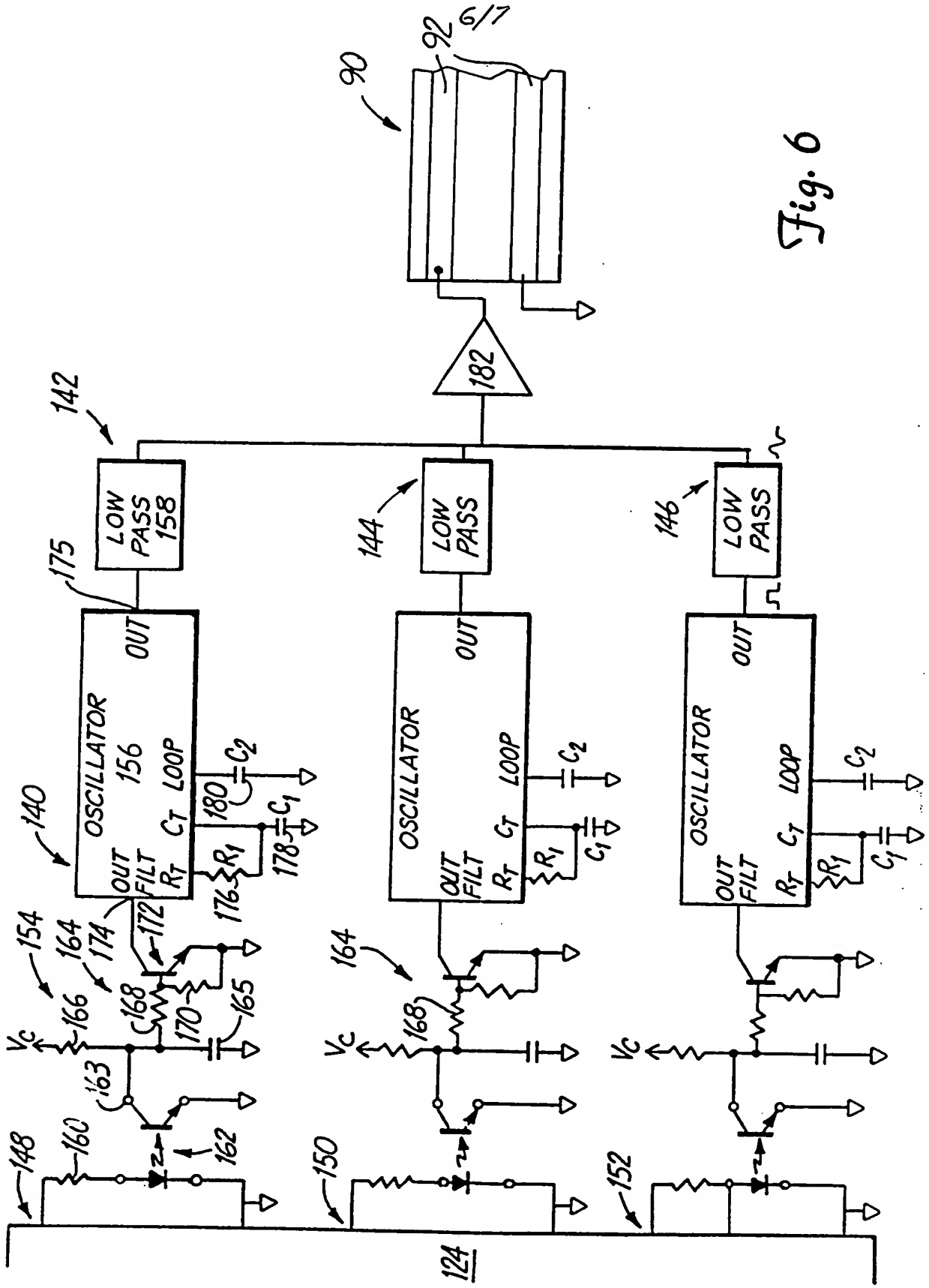
Fig. 5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LOOP
C_T
R_T
C_1
C_2
R_1
140
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Vc
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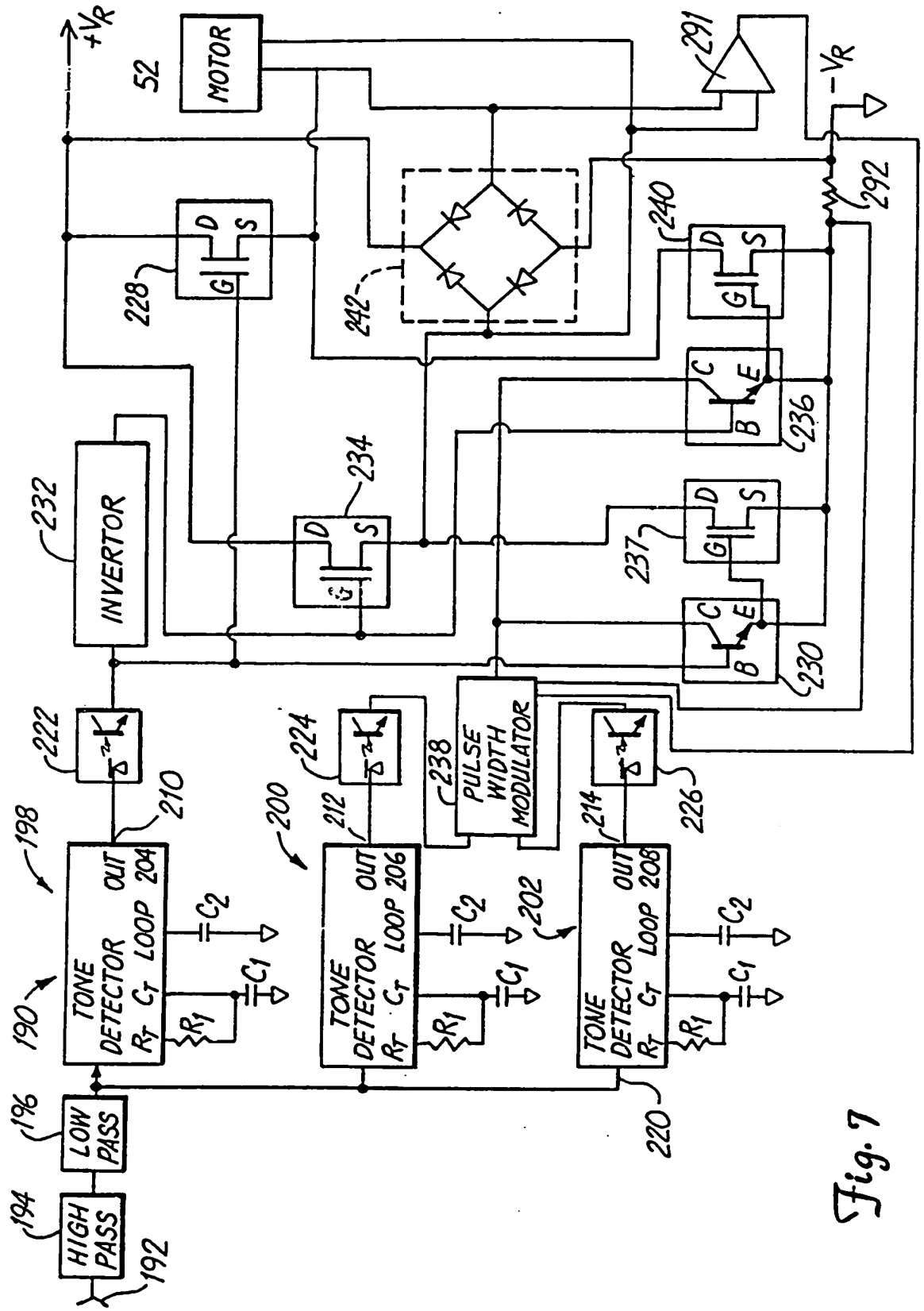
Fig. 6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PULSE WIDTH MODULATOR
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TONE DETECTOR
OUT
LOOP
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206
208
RT
CT
R1
C1
C2
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196
LOW PASS
194
HIGH PASS
192
220

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04639

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H04N 7/18
US CL :358/108; 358/100; 104/295
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 358/109; 358/210; 358/229; 104/209, 296, 297, 138.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 2,531,499 (BEATTY) 28 November 1950, figure 1, column 3, lines 32-75; column 4, lines 1-28.	1-3 4-7
Y	US, A, 3,874,301 (ALIMANESTIANU) 01 April 1975, figure 5, column 3, lines 49 to column 4, line 11.	4-7
Y	US, A, 4,950,119 (NORD ET AL.) 21 September 1990, column 7, lines 14-22.	4-7
A	US, A, 5,018,009 (KOERY) 21 May 1991.	4-7
A	US, A, 2,538,910 (MILLER) 23 January 1951.	1-3 & 8-10
A	US, A, 4,062,294 (COHEN) 13 December 1975.	1-3 & 8-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 23 JULY 1992	Date of mailing of the international search report 10 SEP 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer GLEN BURGESS Telephone No. (703) 305-4792

Form PCT/ISA/210 (second sheet)(July 1992)*

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

FISHER ADAMS KELLY
GPO Box 1413
BRISBANE QLD 4001

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

	Date of mailing *day/month/year* 11 JAN 2001
Applicant's or agent's file reference 1/9140/PC-DKK/NRB	**IMPORTANT NOTIFICATION**

International application No.	International filing date	Priority date
PCT/AU 00/00422	08 May 2000	06 May 1999

Applicant
1. LEXTAR TECHNOLOGIES LIMITED.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translations to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide

Name and mailing address of the IPEA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No.: (02) 6285 3929	MANISH RAJ Telephone No. (02) 6283 2175

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1/9140/PC-DKK/NRB	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. **PCT/AU 00/00422**	International filing date *(day/month/year)* 08 May 2000	Priority Date *(day/month/year)* 06 May 1999

International Patent Classification (IPC) or national classification and IPC

Int. Cl.[7] H04N 7/18

Applicant

1. LEXTAR TECHNOLOGIES LIMITED

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of **3** sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of **1** sheet(s).

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

Date of submission of the demand	Date of completion of the report
05 December 2000	03 January 2001
Name and mailing address of the IPEA/AU	Authorized Officer
AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	MANISH RAJ Telephone No. (02) 6283 2175

International application No.
PCT/AU 00/00422

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **2-21**, as originally filed,
pages **1**, filed with the demand,
pages , received on with the letter of .

☒ the claims, pages **22-28**, as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages , received on with the letter of .

☒ the drawings, pages **1/14-14/14**, as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of .

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-38	YES
	Claims		NO
Inventive step (IS)	Claims	1-38	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-38	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

1. Claims 1-38 are novel and involve inventive step because no individual citation or obvious combination of citations teach the combination of features claimed in the independent claims.

2. Claims 1-38 have industrial applicability because the invention claimed can be made or used in the industry.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 21 December 2000 (21.12.00)	
International application No. PCT/AU00/00422	**Applicant's or agent's file reference** 9140PC1-DK
International filing date (day/month/year) 08 May 2000 (08.05.00)	**Priority date** (day/month/year) 06 May 1999 (06.05.99)
Applicant SIMPSON, Peter, Kenyon et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   05 December 2000 (05.12.00)

   [ ] in a notice effecting later election filed with the International Bureau on:

   _____

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Claudio Borton
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38